BUREAU OF HYGIENE AND TROPICAL DISEASES.

TROPICAL DISEASES BULLETIN.

Vol. 32.] 1935. [No. 4.

HELMINTHIASIS.

BROWN (Harold W.). **Intestinal Parasitic Worms in the United States. Their Diagnosis and Treatment.**—*Jl. Amer. Med. Assoc.* 1934. Sept. 1. Vol. 103. No. 9. pp. 651–660. With 1 text fig. [34 refs.]

" I shall outline the various treatments that have been found most effective and point out the dangers inherent in such forms of treatment."

Diagnosis is first dealt with, it being pointed out that it is inexcusable to treat for worms without direct evidence of their presence. For microscopic diagnosis the use of several smears and of an examination of a 1 in 20 faecal suspension in saturated salt solution by indirect gravity floatation is held to exclude all, or at least all significant, infections by the common intestinal parasites. " Those interested in diagnosing very lightly infected persons should refer to the method of Lane," the apparatus, however, being held too expensive for the average doctor with only an occasional case to diagnose. [Over 10 years ago the reviewer explained how anyone possessing a centrifuge could use D.C.F. by cheap additions.]

In treatment adequate post-treatment purgation is held of great importance. As to hookworms thymol is dismissed as producing unpleasant symptoms (extreme dizziness and vomiting), oil of chenopodium as occasionally killing in accepted therapeutic doses, betanaphthol for its well known toxicity, carbon tetrachloride for the liver necrosis with occasional death which its causes. The drug of election is tetrachlorethylene in adult dosage of 3 cc.; apparently in contradistinction to the dizziness caused by thymol the giddiness which it produces must not, it is held, be taken as an indication of intoxication but as something to be expected. " Various workers report from 77 to 97 per cent. of hookworms removed by a single treatment." For children and the debilitated, hexylresorcinol may be given in dosage of 0·1 gm. for each year of age up to 10, with 1 gm. as maximum for all ages, which will cure approximately 70 per cent. of cases. [In this dosage LAMSON *et al* reported that the *uncured* as tested by an inadequate diagnostic method were 59 per cent. (this *Bulletin*, Vol. 29, p. 56).]

For ascaris infection hexylresorcinol is given first place with a cure rate of 70 to 80 per cent. after one, and 93 to 98 per cent. after two

treatments. The second place is occupied by oil of chenopodium with a maximum dosage of 1·5 cc., which must be measured by cubic volume and not by drops on account of varying viscosity of various samples. [The essential reason is that drops of the same sample from different droppers vary in size. It is not mentioned that the ascaridole content varies greatly in different consignments, and that in giving any poisonous drug there should be knowledge of the dosage of the toxic principle.] Santonin is given third place with a cure rate of 60 to 80 per cent.

For mixed ascaris and hookworm infections hexylresorcinol is advised on the ground of the reputed cure rates mentioned above; for thread worms hexylresorcinol by mouth and by enema of a strength of 1 in 1,000; for tapeworms, carbon tetrachloride or male fern; for strongyloides, gentian violet; and for trichinella, strong purging to sweep away any adults which may not have penetrated the mucosa.

Clayton Lane.

KELLER (A. E.) & LEATHERS (W. S.). **The Incidence and Distribution of *Ascaris lumbricoides*, *Trichuris trichiura* and *Hymenolepis nana* in Mississippi.**—*Amer. Jl. Hyg.* 1934. Nov. Vol. 20. No. 3. pp. 641–654.

In examining faecal specimens for hookworm ova in Mississipi (this *Bulletin*, Vol. 31, p. 795) the presence of other ova was noted. This report covers ascaris, trichuris, *H. nana* and threadworms.

Since the examination was made by the Stoll-Hausheer method, it may be noted in comment that the true incidence of trichuris ova can certainly not have been disclosed by it. The investigation covered 44,380 whites and 6,353 negroes. The respective positive percentages were, for ascaris 0·9 and 2·5, for trichuris 0·03 and 0·016, and for hymenolepis 0·4 and 0·17; those for enterobius, namely 0·025 and 0·031, do not of course represent the actual incidence. The incidence and intensity of ascaris were highest for both races in children under 10 years old, most infections disclosed less than 10,000 eggs per gram, and they were lighter in whites than in negroes. Moreover, individual counts became greater as the number of infected persons in a family increased. While no study of the environments of these families was made, it is mentioned as proved that this infection is acquired by contamination of hands with soil in which embryonated ascaris eggs are present. Of the 578 specimens in which these eggs were present, they were all unfertile in 277, all fertile in 101, and mixed in 41.

Most of the 17 trichuris cases occurred in places close to sea level with high rainfall. The highest incidence of *H. nana* lay under 10 years of age and is much the same as that discovered by the Rockefeller Sanitary Commission (1910–1914). *C. L.*

PARDINA (José M.). Parasitosis apendicular en Córdoba (R. A.). [**Parasites in the Vermiform Appendix in Córdoba, Argentina.**]—*Prensa Méd. Argentina.* 1934. Aug. 29. Vol. 21. No. 35. pp. 1635–1640. With 5 figs. [22 refs.]

The author examined 395 appendices removed by operation, 99 from children under 12 years of age, and 296 from adults. Of 99 from children, 39 contained parasites, namely, *Enterobius vermicularis* 38 (in numbers up to 14, female worms largely predominating), and

Trichuris trichiura one. Of 57 removed for acute inflammation 9 contained parasites (15·7 per cent.), while of the 42 chronic appendicitis specimens 30 (71·4 per cent.) showed parasites.

Of the 296 removed from adults 69 (23·3 per cent.) were parasitized. Seventy-two were acutely inflamed and of these 4 (5·5 per cent.) had parasites, whereas of the 224 chronic cases 65 (29·0 per cent.) were so affected. Enterobius was present in 67 of the 69, in numbers up to 27 ; one showed trichuris, and one fragments of *Taenia saginata* [see also Bacigalupo, this *Bulletin*, Vol. 27, p. 956]. *H. H. S.*

Vo-Van (C.). Les helminthiases dans la population infantile de la region provencale. [**Helminth Infection in Children of Provence.**] —*Marseille-Méd.* 1934. May 5. Vol. 71. No. 13. pp. 578–582.

The faeces of 100 children between 2½ and 14 years were examined. Examination of these hospitalized children was in all cases (1) macroscopic, faeces being diluted in normal saline and strained, (2) a squash preparation 50 by 22 mm., (3) a Telemann preparation. The results were :—

	Indigenous.	Immigrants.	Total.
Examined	78	22	100
Parasitized	65	16	81
T. trichiura	65	15	80
A. lumbricoides	8	6	14
E. vermicularis	2	2	4
A. duodenale	1	1	2
H. nana	1	2	3
Unidentified	1	0	1

The histories of the cases of *A. duodenale* infection are given. *C. L.*

Le Moult & Pirot. Quelques données statistiques et cliniques sur le parasitisme intestinal des tirailleurs sénégalais en garnison à Toulon. [**Intestinal Parasites of Senegalese Troops at Toulon.**]—*Arch. Méd. et Pharm. Nav.* 1934. July–Aug.–Sept. Vol. 124. No. 3. pp. 342–348.

—— & ——. Note sur quelques essais thérapeutiques dans l'ankylostomose. [**Treatment in Ankylostomiasis.**]—*Ibid.* pp. 348–351.

A hundred Senegalese admitted to hospital for various complaints had faecal examinations by smear and by certain concentrative methods.

The parasitic findings were :—*E. dysenteriae* 4, *E. nana* 5, *E. coli* 23, *G. intestinalis* 1, trichuris 20, ascaris 9, hookworms 83, strongyloides 4, *T. saginata* 13, *S. mansoni* 13. Judging by egg measurements the hookworms were necators and 20 suffered from definite symptoms.

As to treatment, thymol in average doses of 1·5 grams (22·5 grains) was [naturally] inefficient and its abandonment is accordingly advised. Chenopodium, on an experience of 58 cases, is [unjustifiably] held to be without inconveniences, its ascaridole content is unnoted, it was given

in doses of 1·5 cc. and proved fairly efficient. Tetrachlorethylene on the strength of 8 cases is held to be always efficient in doses of 3, 4 and 5 capsules of unstated size given on three consecutive days. *C. L.*

i. Vassilkova (Z.); ii. Korovitski (L.) & Artemenko (V.). [**The Rôle of Sewage-Farms in the Epidemiology of Helminthic Infestations.**]—*Med. Parasit. & Parasitic Dis.* Moscow. 1934. Vol. 3. No. 2. [In Russian pp. 149–163; 163–178.]

Two papers devoted to an investigation of the degree of infection with helminth eggs of sewage-farms and the vegetables grown in them.

i. The work was carried out in the outskirts of Moscow. In the water of the sewage collector and irrigation canals eggs of helminths were found per litre as follows. *A. lumbricoides* 700, *E. vermicularis* and *D. latum* 7, *T. trichiura* and *H. nana* 6. In the earth of the beds the eggs of the same forms occurred in smaller quantities, those of *H. nana* and *T. trichiura* being slightly altered. In the sediment obtained by washing vegetables used for consumption in the raw state (lettuce, cucumbers, radishes, tomatoes and cabbage), whether grown on the sewage-farm or exposed for sale in the Moscow markets, there occurred in addition eggs of Taeniids and of Dicrocoelium.

ii. This work was carried out in a sewage-farm of Odessa. The water of the irrigation canals contained 1,428 helminth eggs per 402 litres in the following proportions: *T. trichiura* 1,174, *A. lumbricoides* 217, *H. nana* 23, Taeniidae spp. 2, *Parascaris equorum* 3, *Toxocara mystax* 1, *Toxascaris leonina* 1, *Opisthorchis felineus* 1, Trichostrongylidae and Ancylostomidae 6. Samples of earth contained eggs of the first two only. Insolation causes the degeneration of practically all the eggs contained in the earth to a depth of 2 cm. within 6 days after the irrigation. The number of viable eggs recovered from the vegetables (radishes, green onions, carrots, etc.) was negligible, and it is concluded that sewage manuring is of no epidemiological importance in the spread of helminthic infections in Odessa. [See, however, this *Bulletin*, Vol. 31, p. 611.] *C. A. Hoare.*

Podyapolskaya (V.) & Gnedina (M.). Sur le rôle des mouches dans l'épidémiologie des helminthoses. [**The Rôle played by Flies in the Epidemiology of Helminthic Infestations.**]—*Med. Parasit. & Parasitic Dis.* Moscow. 1934. Vol. 3. No. 2. [In Russian pp. 179–185. French summary p. 185.]

The authors conducted a series of laboratory and field observations on the part played by the house-fly (*Musca domestica*) and the blue-bottle (*Calliphora erythrocephala*) in the dissemination of the eggs of helminths. In the experimental part flies were allowed to feed during one or two days on human faeces or manure containing the eggs of ascaris, trichuris or diphyllobothrium, either from natural infections or added to the material. Eggs of the first and last, but not of trichuris, were later recovered from the legs and chiefly from the wings of the flies, but none were found on the proboscis. They occurred in large numbers in the droppings of blue-bottles, but not in those of the house fly, probably owing to the fact that the length of the eggs of the helminths used in the experiments exceeded the diameter of the proboscis in the latter insect.

About 2,500 fly droppings were collected on slides scattered in a slaughter-house and a railway dining room, in both of which flies were abundant. In two of the droppings from the abattoir were found eggs of *Dicrocoelium lanceatum*, while in one from the dining room an egg of *Trichuris trichiura* was present. *C. A. Hoare.*

EGYPT: Ministry of the Interior, Dept. of Public Health. **Sixth Ann. Rep. of the Endemic Diseases Section for 1933** [TOMB (J. Walker), Director].—21 pp. With tables & 1 map. 1934. Cairo: Govt. Press.

I.—ANKYLOSTOMA AND BILHARZIA BRANCH (pp. 1–3).—The numbers treated for hookworm are not stated; it is, however, noted that the distribution of infection among the new patients attending the various branches of the endemic diseases section during 1933 was 164,131. "Only" three deaths were reported from carbon tetrachloride during the year. The use of the drug has been discontinued for trichuris, trichostrongylus, hymenolepis, strongyloides and heterophyes. Of 711,080 persons examined for urinary bilharziasis 58 per cent. were infected; of 685,616 examined for intestinal bilharziasis 23 per cent. were found infected with *S. mansoni*, 2 per cent. with *S. haematobium* and 0·4 per cent. with *E. histolytica*. *C. L.*

ABDULKADIR-LUFTI. Xanthochromie und Darmparasiten. [**Xanthochromia and Intestinal Parasites.**]—*Deut. Med. Woch.* 1934. Sept. 28. Vol. 60. No. 39. pp. 1472–1475.

The intestinal absorption of lipochrome is increased in various circumstances, the presence of necator and ascaris being the chief of these. *C. L.*

HALL (Maurice C.). **Principles and Theories of Anthelmintic Medication.**—*Puerto Rico Jl. Public Health & Trop. Med.* 1934. June. Vol. 9. No. 4. pp. 418–433. [Spanish version pp. 434–446.]

"Anthelmintic medication, although in principle and theory analogous to medication in general, deserves more consideration and attention than it has heretofore received. Even now, too little is known concerning long-used remedies and that little is apt to be somewhat vague and empirical."

Five questions are asked and answered. What is the essential factor in successful and safe anthelmintic medication in practice? Good judgment and experience in the physician.

What should the physician know about parasites in order to treat parasitism successfully? The habits and life histories. Thus, ascarids may enter pancreatic and bile ducts and so be unreached by anthelmintic drugs. Hookworm and other larvae may not be in the alimentary canal at the time of deworming, but by reaching it later may cause eggs to reappear in the faeces without post-treatment reinfection. The gravid threadworm leaves the anus to oviposit so that her eggs are rarely found in the faeces.

What should the physician know about anthelmintics in order to use them effectively and safely? The drug to choose in each case, its dose, its effect on the patient, the purgative and its dose. Thus santonin makes ascaris drunk and disorderly, the muscular incoordination being presumably an effect on its central nervous system. *In vitro* experiments to study this have not been made but the results

of such can be transferred to parasitic conditions only with discrimination ; thus " if alcohol were an anthelmintic *in vivo* as well as *in vitro* man should have been rid of his worm parasites ages ago." Great stress is laid on purgation in giving post anthelmintic safety ; Hall's own theory—he insists that it is theory—is that a purgative by moving the drug along slows absorption and prevents injury from excessive absorption at any particular spot ; Glauber's salt is preferred to Epsom salt and it should be one-third saturated. Pretreatment purging is valuable in constipation and where mucus must be removed as in the case of small worms and the small heads of tapeworms, and oils and alcohol should be forbidden before an anthelmintic. A partial removal of worms may have a great temporary clinical value.

" The Stoll egg count has the limitation that while it takes advantage of mathematical probabilities and does so on a very sound basis, this same element of mathematical probability will go against the method when there are very few eggs and large amounts of feces, as a negative egg count under those conditions will not be truly indicative of the absence of egg-producing females. Under such conditions resort must be had to such elaborate methods as the Lane technic, an excellent technic, with the only disadvantage of being somewhat intricate."

Note is made on the possible correlation between chemical structure and anthelmintic efficiency of drugs.

What should the physician know about purgatives ? Saline purgatives act rapidly, produce an osmotic flow into the intestinal lumen and so prevent an absorption flow in the opposite direction. If given, castor oil should accompany the anthelmintic.

What should the physician know about the patient ? As much about his present state as is necessary before giving any drug, and in particular his habits as to alcohol and fat consumption and pregnancy in the case of a woman.

What should the physician know about prophylaxis ? The life history of the parasite concerned. *C. L.*

TUBANGUI (Marcos A.), BASACA (Mariano) & PASCO (Antonio M.). **Hexylresorcinol as an Anthelmintic : its Efficiency against the Intestinal Parasites of Man.**—*Philippine Jl. Sci.* 1934. Aug. Vol. 54. No. 4. pp. 473–481.

The effects on worms and hosts of hexylresorcinol administered to 861 patients in adult dosage of 1·2 gm. in field conditions. Only 381 reported for re-examination.

The drug was given fasting, either in gelatin capsules, which mostly arrived broken, or in sugar coated pills. The purge, when given, was sodium sulphate. The anthelmintic effects were measured by Stoll-Hausheer egg counts once before, and once 10 to 14 days after, treatment and reduced to a " formed basis." [In the case of hookworms and trichuris deworming was not thereby disclosed.] They were as follows :—

Ascaris.—Capsule and purge in 88 cases ; percentage of eggs remaining 50, of manifestly uncured 89. Pills without saline in 232 cases ; percentage of eggs remaining 18, of manifestly uncured 47. Pills and purge in 61 cases ; percentage of eggs remaining 15, of manifestly uncured 36.

Hookworms.—Capsule and purge in 103 cases ; percentage of eggs remaining 66, of manifestly uncured 92. Pills and purge in 62 cases ; percentage of eggs remaining 26, of manifestly uncured 75.

Trichuris.—Pills without purge in 229 cases; percentage of eggs remaining 72, of manifestly uncured 91. In 46 there were more eggs after than before treatment the greatest difference being 200 per gram. before as against 4,600 after.

Threadworms.—Worms were expelled or symptoms relieved in 13 of 17 cases. In 2 cases enemata of the drug of unstated strength removed great numbers.

Taenia saginata.—In 2 cases tested the head was not passed.

Effects on the host were, in some individuals, slight gastric or intestinal irritation, and transient headache and dizziness. One woman vomited through the nose and has severe burns of the nasal passage. *C. L.*

MANSON (D.). **A Comparative Record of Anthelmintic Treatment with Tetrachlorethylene and Oil of Chenopodium.**—*Indian Med. Gaz.* 1934. Sept. Vol. 69. No. 9. pp. 500–507.

Four hundred tea garden coolies showed no adverse results from tetrachlorethylene, indeed they enjoyed taking the drug. The anthelmintic effects on hookworms, whipworms and threadworms are reported.

Three dogs having been made completely drunk with 5 cc. of the drug and being quite themselves again in 3 hours, 100 coolies were treated with 4 cc. of tetrachlorethylene shaken up with 2 ounces of saturated solution of magnesium sulphate and given before separation occurred, and showed no toxic symptoms. Accordingly 300 more were divided into 4 nearly equal groups and treated with (group 1) tetrachlorethylene 4 cc., (2)* 3 cc., (3) 3 cc. with oil of chenopodium 1 cc. and (4) oil of chenopodium 3 cc. The incidence of symptoms in each group is tabulated. Here are some of the highest percentage figures: No symptoms (4) 75·00, vertigo (4) 20·83, intoxication (1) 12·5, nausea (3) 6·76, giddiness (2) 12·16, sleepiness (1) 5·0, vomiting (2) 5·41, abdominal pain (2, 3) 2·7, jaundice (3) 1·25.

Evaluation of deworming was by a modification of Stoll's counting method using 0·005 gm. of faeces [so it was not exact for hookworms and whipworms]. So tested, the percentages in which no hookworm eggs were found were (1) 60·00, (2) 44·07, (3) 59·65, (4) 51·61; the corresponding figures for roundworms were 64·61, 55·17, 68·97 and 47·60, and for whipworms 41·3, 35·94, 45·71 and 33·87. The figures are further considered statistically. *C. L.*

ORENSTEIN (A. J.). [**Alleged Dangers of the Administration of Fouadin.**] [Correspondence.]—*Jl. Trop. Med. & Hyg.* 1934. Oct. 1. Vol. 37. No. 19. p. 304.

Fouadin should not be given intravenously and daily, but intramuscularly and on alternate days.

Reference is made to CAWSTON's insistence on risk of hepatic damage from fouadin. After mentioning hepatic symptoms following the former method of administration, Orenstein continues:—

"Thereafter all administrations of fouadin were intramuscular and on alternate days. More than 300 school children were treated at various treatment centres organized during school holidays. Not a single case of liver damage was observed in any of these.

"With regard to the efficacy of fouadin as against sodium antimony tartrate, on the basis of the Anti-Bilharzia Committee's experience it can

*The bracketed figures throughout refer to these groups.

be stated that fouadin is approximately as efficacious as the sodium antimony tartrate, provided it is given in proper dosage. Its advantages are relative ease of administration, absence of the danger of local damage associated with intravenous injections of antimony salts, and absence in the majority of cases of any unpleasant by-effects, such as nausea, vomiting, coughing and rigors. Its sole disadvantage, so far as we can judge, is the high cost of the drug.

"In addition to the experience cited above I have had a considerable personal experience with the administration of fouadin, and this taken together with the school treatment centre experience, convinces me that there is no discernible danger of liver damage associated with the proper administration of fouadin." *C. L.*

FAKHRY (A.). **Antimony Dermatitis treated with Sodium Thiosulphate.** —*Lancet.* 1934. Dec. 22. p. 1394.

Sodium thiosulphate acted rapidly on a case of arsenical dermatitis due to fouadin.

The eruption appeared after the first injection and was aggravated by the second; it lessened after one and disappeared after two intravenous injections of 10 cc. of a 10 per cent. solution of sodium thiosulphate. *C. L.*

FAKHRY (Asaad). **Tartar Emetic Collapse and Adrenaline.**—*Jl. Egyptian Med. Assoc.* 1934. Oct. Vol. 17. No. 10. pp. 851–856.

This collapse is accompanied by a slow weak pulse. Vagus stimulation is suspected as the cause. Adrenalin injection is advocated in treatment and a mixture of tartar emetic with atropine is being tried to prevent it. *C. L.*

OESTERLIN (M.) & KRAINICK (H.). Orientierende Versuche zur Chemotherapie der Helminthen. [**Trial Experiments on the Chemotherapy of Helminths.**]—*Zent. f. Bakt.* I. Abt. Orig. 1934. Aug. 7. Vol. 132. No. 3/4. pp. 222–228.

Seventy-eight chemical substances falling into 10 groups were investigated *in vitro* as to their toxicity to certain helminths, and the results described and tabulated.

Fasciola hepatica.—Of 57 substances tested against the adult flukes, only three showed any efficiency, namely cresyl blue, 3-amino-6-iodacridine and allyl naphthol. The first was the best, but it had no effect *in vivo*.

Strongyloides stercoralis larvae.—Of 35 substances tried, flavizid and rheonin A, both acridine dyes, proved more effective than gentian violet, a triphenylmethane. Rivanol and trypaflavine, both acridine dyes, were of little value.

Opisthorchis felineus was very resistant, but among 22 substances tested was injured by phenol derivatives, especially hexylresorcinol.

Schistosoma mansoni was tested as to cercariae against 58 substances, acridine dyes killing them but the complex antimonials failing to do so. The adults were subjected to 14 substances; cresyl blue was effective, so was 3-amino-6-iodacridine *in vitro*, but it failed on mice *in vivo*.

Against *Microfilaria diurna* 15 substances were tried, mostly acridine dyes; only rheonin and flavizid had any effect. *C. L.*

HARWOOD (Paul D.). **Effect of Certain Physical Factors on the *in Vitro* Testing of Anthelmintics.**—*Proc. Soc. Experim. Biol. & Med.* 1934. Oct. Vol. 32. No. 1. pp. 131–133.

In vitro tests of drugs against *Ascaris lumbricoides* show that a " liquid excess " of the drug is far more effective than a solid one.

If hexylresorcinol (or certain other drugs) is allowed to stand in contact with 1,000 parts of 0·9 per cent. sodium chloride solution at 37°C., a solid excess will remain. If the same mixture is heated and allowed to cool to 37°C. " the undissolved excess is a supercooled liquid." The latter is far more rapidly lethal than the former to ascaris *in vitro*. *C. L.*

LAMSON (Paul D.), BROWN (Harold W.) & HARWOOD (Paul D.). **The Anthelminthic Properties of Certain Alkyl Phenols.**—*Amer. Jl. Trop. Med.* 1934 Sept. Vol. 14. No. 5. pp. 467–478. With 5 charts. [13 refs.]

The result of studies of 4 series of alkyl phenols on ascaris from the pig at 37°C.

" Although we have not yet succeeded in our attempts to find a more practical ascaricide than hexylresorcinol, we have found a number of compounds which act as well in vitro and when further tests are made some of them may prove as effective in vivo. However, they have the same complicating factor of causing local irritation as hexylresorcinol. It is quite possible, however, that certain of these substances may be so modified that they can be given in a form which will be non-irritating in the mouth yet active on the parasite." *C. L.*

BRANDT (W.). Ueber die Wirkung von Küpfer auf Eingeweidewürmer. [**Action of Copper on Intestinal Worms.**]—*Med. Klin.* 1934. Oct. 19. Vol. 30. No. 42. pp. 1399–1400. With 1 fig.

In vitro experiments indicate that cupronat, a copper-containing solution of a strength of 3·5 mgm. per cent., produces tonic contraction of the muscles of ascaris and so will further their expulsion from the intestine.

C. L.

GORDON (R. M.), DAVEY (T. H.) & PEASTON (H.). **The Transmission of Human Bilharziasis in Sierra Leone, with an Account of the Life-Cycle of the Schistosomes concerned, *S. mansoni* and *S. haematobium*.**—*Ann. Trop. Med. & Parasit.* 1934. Oct. 19. Vol. 28. No. 3. pp. 323–418. With 19 figs., 1 diagram, 1 graph and 3 plates (1 coloured). [57 refs.]

Experiments with bred snails show that in Sierra Leone *Schistosoma mansoni* is spread by *Planorbis pfeifferi* and *S. haematobium* by *Physopsis globosa*. The morphology and biology of the immature stages is fully considered.

Of necessity there are details here of purely local importance, but even so their implications are wide. Moreover the case and argument are so closely reasoned that the reviewer finds it impossible to write a satisfying abstract in a reasonable space.

The section on *S. mansoni* points out the evidence that the infection has been introduced only recently from French Guinea [MAASS and

Vogel, this *Bulletin*, Vol. 28, p. 194], has spread more widely than has been realized, and has been partly controlled by appropriate measures. The highest general incidence occurs in women, for these draw all domestic water and wash all clothes. At Kabala the only snail infected with human type cercariae was *Plan. pfeifferi*; of 1,751 dissected 9·6 per cent. showed cercariae of this type, and experiments on 11 guineapigs and 5 cercopithecus monkeys showed that only *S. mansoni* was concerned. Laboratory bred snails were exposed to attacks of miracidia obtained from this fluke in numbers from 6 to 47 per snail; of 810 *Plan. pfeifferi*, 458 survived for examination, and of 325 tested for cercarial discharge 85·8 per cent. were positive, while of 133 dissected 75·2 were positive; most of the snails lived provided the miracidial concentration of the water in which they were did not exceed 10 per snail and provided the average temperature during development in the snail did not rise above 33°C., so that in the natural conditions locally obtaining most snails will live to discharge cercariae. The authors in parallel experiments failed to infect either *Lymnaea elmeteitensis* or *Physopsis globosa* with miracidia of *S. mansoni*. As to ecology the distribution of *Plan. pfeifferi* is very patchy, but most are found in about equal numbers, either on the stream bottom or on the leaves and roots of water plants, particularly of *Acroceras zizanioides* and *Eleocharis fistulosa*; but the clearing of the stream of these plants merely led to a wider distribution of these snails. The temperature associated with the lowest death rate of *P. pfeifferi* lay between 25°C. and 33°C.; if it reached 37°C. all of them died in a few days; they can withstand partial drying for many days, and complete drying for at least 92 hours, if they have learnt to adapt themselves to this, but if the effects of direct sunlight are added they die in a few hours. Breeding probably goes on throughout the year but there is a marked increase of very young forms at the beginning of the rainy season. Full growth is reached in about 6 months and the miracidia of *S. mansoni* show marked preference for half grown forms.

S. haematobium infects 13 per cent. of the inhabitants of Kabala, yet no known snail vector is found in that village—to be precise *Phys. globosa*, an established vector, was not found among nearly 10,000 snails collected. Bred *Plan. pfeifferi* could not be infected with these miracidia, nor could *L. elmeteitensis*, but *Physopsis globosa* was so to the extent of 90 to 100 per cent. in small series and of 72·8 per cent. of 262 specimens, and 3 cercopithecus became infected with *S. haematobium* after entry of human type cercariae obtained in one from wild and in two from laboratory bred *Phys. globosa*. Infected *P. globosa* die less readily after infection with *S. haematobium* than do *Plan. pfeifferi* after that with *S. mansoni* (27·5 as against 43·5 per cent.). As to ecology *Phys. globosa* is essentially a bottom and a mud feeder, likes water contaminated with human excreta and is commonest in bathing pools. It withstands a higher temperature than does *Plan. pfeifferi*.

As to the morphology of the larval stages, the miracidia are alike except for the orientation of the 4 large flame cells. In *S. mansoni* their axes lie in the " antero-posterior plane " so that they appear as refractile spheres each containing a flickering cilium; in *S. haematobium* their long axes are " at right angles to this plane " so that they appear as typical long pyramidal-shaped flame cells. The sporocysts, at first motionless besides the tentacles, elongate and become motile and multiply so that 150 have been found in a snail exposed to an average of 10 miracidia. These " type I " sporocysts soon invade the muscles

and finally the liver, become type II motionless, cellular, double outlined and bead-necklace-like, and finally type III with germ balls from which the cercariae develop. A feature, first brought to the authors' notice by Hans VOGEL, is the presence of " tactile hairs " particularly on the anterior and posterior* aspects of the ramus of the tail and on the inner aspects of the furci. The cercarial anatomy is fully described and the authors find no differences at all between those of the two species. Both have 5 pairs of glands.

" The conclusion was reached after the examination of large numbers of cercariae of both species under consideration that there were present two pairs of anterior coarsely granular glands and their ducts which stained selectively with alizarin, and that there were three pairs of posterior finely granular glands and their ducts which stained selectively with lithium carmine or Best's carmine and that neither in the number, situation or reactions of the cephalic glands could the cercariae of *S. mansoni* be differentiated from those of *S. haematobium* as found in Sierra Leone."

In both species the cercariae have 4 pairs of flame cells in the body and 1 pair in the tail and two pairs of ciliated areas in the collecting channels. The existence of the fourth pair in the body of *Cercaria haematobium* is easily overlooked since the 2 pairs in the posterior body overlie one another in dorso-ventral view.

From 50 to 1,000 cercariae may be discharged daily from a snail and the discharge apparently continues as long as the snail lives. As to the effects of temperature, the optimum for rapid development of both species in these particular snails is 32° to 33°C. A drop from 32° to 21°C. increases the duration of the developmental cycle of *S. mansoni* in *Plan. pfeifferi* from 15 to 35 days ; and that of *S. haematobium* in *Phys. globosa* from 23 to 67 days : moreover, whereas at 33°C. the migrating sporocysts in *Plan. pfeifferi* could be obtained in tens, at 20°–22°C. they could be counted in hundreds. An appendix describes—methods of transporting live snails and of breeding them ; aquaria for incubating infected snails at various temperatures ; the media, fixations and stains used in studying the developmental cycles of the worms ; the special techniques used ; the methods employed to study development in the snails, and methods of mounting adult schistosomes. *C. L.*

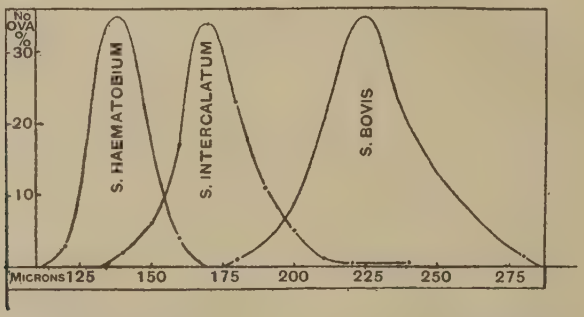
FISHER (A. C.). **A Study of the Schistosomiasis of the Stanleyville District of the Belgian Congo.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1934. Nov. 27. Vol. 28. No. 3. pp. 277–306. With 1 fig., 3 graphs and 2 plates. [22 refs.]

Intestinal schistosomiasis accompanied by terminal-spined ova occurs in the Stanleyville District of the Belgian Congo [*vide* C. C. CHESTERMAN 1923 ; this *Bulletin*, Vol. 20, p. 939] and the worms are held to form a new species which is designated *Schistosoma intercalatum*. The work was made possible by a grant from the Royal Society.

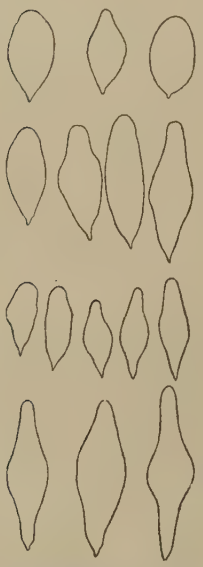
There has been unbroken failure to infect *Physopsis africana* experimentally with miracidia from ova passed in the faeces of these infected persons ; however, 1 to 3 per cent. of these snails taken from quiet

*Evidently ventral and dorsal which will then be the meaning of the terms used for the miracidial flame cells. The authors write that these hairs " do not appear to have been recorded hitherto." TAKAHASHI, however [this *Bulletin*, 1928, Vol. 25, p. 950], writing on the cercaria of *S. japonicum* says—" There are certain numbers of sensory organs (a process with a delicate hair) on the surface of the body and tail." They are figured in the Japanese version of the paper.

river reaches give off " human bilharzia cercariae," and with these mice and a sheep have been infected. The descriptions of the adults are given with the comment that " none of the morphological characteristics of this parasite, apart from the ovum, are such as to enable it to be differentiated clearly from either *S. haematobium* or *S. bovis*. The size of mature intrauterine ova averages 130 by 40 μ, while those in faeces in man and experimental animals measure 140 to 240 μ by 50 to 85 μ with an average of 175 by 60 μ. As to shape, " eggs of the short, squat variety may readily be confused with those of *S. haematobium*, though as a rule, a distinction can be made by the more rounded extremities of the last-named species. On the other hand long spindle-shaped eggs may strongly resemble those of *S. mattheei*



Length-frequency curve for mature ova of *S. intercalatum*, from human faeces, compared with approximate frequency curves for *S. haematobium* and *S. bovis*.



Mature ova of *S. haematobium*.

Mature ova of *S. intercalatum*.

Intra-uterine ova from several female *S. intercalatum*.

Mature ova of *S. bovis*.

A comparison of the shape of ova of *Schistosoma intercalatum* with those of *S. bovis* and *S. haematobium*.

[Reproduced from the *Transactions of the Royal Society of Tropical Medicine and Hygiene*.]

or *S. bovis*, but these ova never reach such large dimensions as in *mattheei* and *bovis*." The spine may attain a length of 20 μ; "this usually serves to distinguish it from *S. haematobium*."

No natural hosts other than man have been found. The shortest interval after exposure to infection in which ova appeared in the faeces of mice was 41 days. Spinster worms are short and flattened and may have incurved edges reminiscent of the male, and while still fresh a few scattered cuticular bosses; the acetabulum is markedly developed. Since Fisher has found a single pair of coupled worms surrounded by ten spinsters and has never found a wedded female unless attended by her mate he notes this steadfast monogamy and believes with Brumpt that the female does not leave her mate for oviposition. [As Cawston has repeatedly insisted, gravid female worms are easier to kill than males. Are spinster females with their male characters also resistant to poisoning, and can re-appearance of eggs after drugging be due to surviving males taking up with surviving spinsters?]

This intestinal infection occurs in villages for 100 miles along the Congo from the Stanley Falls down to the mouth of the Lomami River and has also been found in a child from Bengamisa 50 miles up the Lindi River which flows into this stretch of the Congo from the north. The snails are found in thousands in quiet shady stretches of the river which are used as latrines by villagers and boatmen. If they have been shedding cercariae for long they become covered with a brown slime. The swimming and penetration movements of the cercariae are described. "It is commonplace to see one man bathing a few feet from the bank, with another easing himself into the water not far upstream" and since washing is constant, opportunities for infection are many.

Sigmoidoscopy shows lesions from the anus to the pelvi-rectal junction and none higher, and the prevalent symptoms are dysentery and abdominal pain; but Chesterton is of opinion that the infection is an important factor in causing an atypical pneumonia commonly encountered here. The infection is one of the young, examinations giving uniformly negative results in those over 30 or 35. Acriflavine was used by mouth in a 2 per cent. solution given in 5 equal daily doses with a total of 0·01 gram per kilo. Symptoms ceased within 48 hours. In 49 cases all but 6 showed no ova, or in 4 cases only degenerate ova, by the time the course was complete; the 6 were quite uninfluenced. Of the 43, 34 were followed up and half showed reappearance of ova. Proflavine gave comparable immediate results in 7 cases, and 2 which were followed up were negative 3 months later. The difficult problem of control is discussed. *C. L.*

Connolly (M.). **On the Planorbid Hosts of Bilharziasis in South and West Africa.**—*Ann. Trop. Med. & Parasit.* 1934. Oct. 19. Vol. 28. No. 3. pp. 439–443. With 12 figs.

Extreme variability of certain species of the red-blooded snails belonging to *Physopsis* and *Planorbis* renders it likely that for medical men the exact trivial name of a local race is of less importance than an old and possibly over-comprehensive one.

Planorbis pfeifferi Krauss, 1848 is the oldest name applied to nearly-allied members of the genus south of Egypt. It attains fairly large

dimensions (15 by 6½ mm. in major diameter and thickness) with 5 slowly increasing whorls ; the aperture is not noticeably larger than the whorl to which it forms the end, and is normally on the same plane with it, though it may incline a little above or below it. It inhabits the greater part of the continent south of the Kunene and Zambesi rivers, but Connolly has noted typical shells from Kenya and Northern Nigeria. Certain specimens from Kabala were submitted to Louis GERMAIN of Paris who reported that they were without question a form of *P. bridouxi* Bourquignat, a synonym of *P. stanleyi* Smith 1888, but that the two forms are closely allied and that " the conclusion is that your *Planorbis* from Sierra Leone is evidently near to *pfeifferi* Krs., but still more so to the forms from L. Chad of *bridouxi*, Bgt., and it seems more suitable to classify it as this species." WATSON reports after a study of the anatomy that the central tooth of the radula differs in a minute detail, exhibiting in 4 dissected snails a small narrow median denticle between the two larger cusps which is held to entitle " *Plan. bridouxi* " to specific rank [GORDON, DAVEY and PEASTON note (p. 237 above), that these differences, recognizable only by an expert, entitle them to continue to use the name familiar to medical men]. As to the difference between *Physopsis africana* Krauss, 1848 and *Ph. globosa* (Morelet), 1866, Connolly writes :—" When describing this species [*P. globosa*] Morelet rightly stressed the fact of its slight rimation, which affords the only real and fairly constant point of difference between itself and *africana*." [In other words it seems that the individual shell cannot always definitely be assigned to either species, so that the medical man need not be too anxious about the distinction.] *C. L.*

VAN DEN BERGHE (Louis). Les schistosomiases humaines et animales au Katanga (Congo Belge). [**Human and Animal Schistosomiasis in Katanga.**]—*Ann. Soc. Belge de Méd. Trop.* 1934. Sept. 30. Vol. 14. No. 3. pp. 313–371. With 5 figs. & 15 plates. [30 refs.]

It is felt that in the Belgian Congo, which comprises the greater part of Central Africa, schistosomiasis has not yet been systematically considered ; hence this study.

During the last 10 years the reported cases of schistosomiasis have steadily increased. Keys of the subfamilies and genera of the Schistosomidae are given. Twelve species are considered of which only 4 (*S. haematobium* and *S. mansoni* of man and *S. bovis* and *S. margrebowiei* of animals) are held to have distinctive characters. Of *S. faradiei* Walkiers, 1928 only the eggs have been described and that without measurements ; the separation of *S. mattheei* from *S. bovis* is not admitted by all. *S. spindalis africana* A. Porter, 1929 is based on shape of egg and size of cercaria, both points difficult of exact determination. *S. curassoni* seems to be *S. bovis* and *S. rodhaini* to be a variety of *S. mansoni* in an abnormal host. *S. intercalatum* Fischer, 1934 is not sharply defined from *S. haematobium* and *S. bovis*. There are dealt with the known local habitats of *Planorbis adowensis, P. sudanicus, Physopsis africana, Bulinus forskalii, Limnaea natalensis, Melanoides crawshayi* and *M. mweruensis*, the effect of season, the percentage of infected molluscs, their cultivation and egg laying. Human infection is considered medically and hygienically. *C. L.*

GAUTHIER (Henri). Enquête sur la répartition en Algérie des mollusques susceptibles de véhiculer la bilharziose vésicale. [**Distribution in Algeria of Potential Mollusc Carriers of** *S. haematobium*.]—*Arch. Inst. Pasteur d'Algérie.* 1934. Sept. Vol. 12. No. 3. pp. 305–350. With 1 map & 9 figs. on 3 plates. [17 refs.]

Bulinus is disappearing in Algeria.

At the end of a survey of local importance and value it is pointed out that acid waters do not harbour this snail, alkaline waters do so here and there but less so than formerly as they are modified by man. Only Lake Onbeira seems likely to be too big to attack economically. *C. L.*

PALLARY (Paul). Enquête sur les bullins en Algérie. Le marais d'en Naro (dép. d'Oran), de formation récente. [**Inquest on the Bulinus of Algeria. The En Naro Marsh.**]—*Arch. Inst. Pasteur d'Algérie.* 1934. June. Vol. 12. No. 2. pp. 255–258. With 1 fig.

No molluscs are found in this swamp, which the author states is of quite recent formation. *A. G. B.*

GOBERT (E.). Note sur la bilharziose en Tunisie. [**Schistosomiasis in Tunis.**]—*Arch. Inst. Pasteur de Tunis.* 1934. Aug. Vol. 23. No. 3. pp. 348–359. With 4 plates (1 map).

Infection by *S. haematobium* through *Bulinus contortus* was investigated at Gafsa and El-Oudiane.

Gafsa.—Percentages infected as ascertained by centrifuging urine were : men 74, women 38·5, boys 58·2, girls 73·4. Where the temperature of water collections was 27°C. or less *B. contortus* was present ; where 28° or over it was absent. The percentage of snails with bilharzial cercariae varied from 0 to 65.

El-Oudiane.—Percentages of children infected varied from 0 to 100 ; only 9 adults were examined and from one locality only ; all were infected. Temperatures of 19 water collections varied from 18° to 29°. The only 3 with infected snails had temperatures of 19°C. *C. L.*

ANDERSON (Ch.) & GOBERT (E.). Note sur la présence, en Tunisie, de *Schistosoma bovis*. Infection naturelle de *Bullinus contortus*. [*Schistosoma bovis* **in Tunis conveyed by** *B. contortus*.]—*Bull. Soc. Path. Exot.* 1934. Nov. 14. Vol. 27. No. 9. pp. 850–852.

Furcocercous cercariae in *Bulinus contortus* in the Mediterranean basin do not necessarily imply infection with *S. haematobium*.

Anderson and Gobert having pointed out that when seeking for haunts of *B. contortus* carrying human furcocercous cercariae they came across these snails infected with *S. bovis*, Professor BRUMPT in discussion pointed out that in 1929 he showed that this trematode and snail were associated in Corsica. [The full description of BRUMPT's convincing series of experiments is found in *Ann. Parasit. Humaine et Comparée*, 1930, Vol. 8, pp. 17–50.] *C. L.*

VIGLIETTA (Carlo). Ricerche sulla diffusione della schistosomiasi vescicale fra i bambini indigeni di Derna. Misure profilattiche adottabili. [**Urinary Schistosomiasis among Children in Derna. Prophylaxis.**]—*Arch. Ital. Sci. Med. Colon.* 1934. Oct. 1. Vol. 15. No. 10. pp. 760–766. [10 refs.] English summary (3 lines).

The oasis of Derna (Cyrenaica) has been reputed as a focus of *S. haematobium*. The author examined 606 children attending the elementary schools ; after centrifuging the urine in each case he found

9 only infected, 1·4 per cent. *Bulinus contortus* is present in the district. For prevention he recommends the usual measures of treating the infected with fouadin, or emetine, destroying the snail with copper sulphate, 5 parts per million, and educating the inhabitants as to methods by which infection is contracted and how to avoid it.

H. H. S.

Barsoum (H.). **The Bilharzial Appendix.**—*Jl. Trop. Med. & Hyg.* 1934. Dec. 15. Vol. 37. No. 24. p. 387.

Schistosomes do not cause appendicitis.

Of 53 appendices thoroughly examined histologically after removal for appendicitis, 19 per cent. showed schistosome eggs. Of 46 appendices taken from bodies dying of different diseases, 28 per cent. showed these ova. The population of Egypt is heavily infected with these parasites, but appendicitis among them is rare. *C. L.*

Lowenthal (H. F.) & Roberts (R. A.). **Bilharzia Affecting the Left Ureter Primarily.**—*Lancet.* 1934. Sept. 29. pp. 706–707. With 1 fig.

A report from Kimberley of a greatly thickened ureter which after removal was shown to be bilharzial and which had caused for 12 months occasional pain on micturation with haemorrhage. These ceased after the kidney and ureter had been removed. Tartar emetic was then given.

C. L.

Faust (Ernest Carroll), Hoffman (William A.), Jones (Charles A.) & Janer (José L.). **Studies on Schistosomiasis Mansoni in Puerto Rico. II. The Epidemiology and Geographical Distribution of Schistosomiasis Mansoni in Puerto Rico. 2. A Survey of Intestinal Parasites in Endemic Schistosomiasis Areas in Puerto Rico.**—*Puerto Rico Jl. of Public Health & Trop. Med.* 1934. June. Vol. 9. No. 4. pp. 447–471. With 1 map. [40 refs.] [Spanish version pp. 472–491.]

"Data are presented on the protozoan and helminth infections of representative cross sections of the Puerto Rican population, based on single specimen examinations of 1,003 persons."

Each specimen was examined, within 24 hours or after standing in a refrigerator, by 3 methods, one diluted in physiological salt solution, one stained with Donaldson's iodine and one an iodine-stained centrifugal precipitate, all being covered preparations.

"The percentages actually found in the Puerto Rican survey are as follows:—*Endamoeba histolytica*, 14·5; *E. coli*, 34·2; *Endolimax nana*, 16·3; *Iodamoeba bütschlii*, 3·5; *Giardia lamblia*, 14·3; *Chilomastix mesnili*, 0·7; *Balantidium coli*, 0·2; *Ascaris*, 9·9; *Necator* (and *Ancylostoma*), 33·5; *Trichocephalus*, 44·6; *Strongyloides*, 4·6; *Enterobius*, 0·4; *Schistosoma mansoni*, 12·2 and *Hymenolepis nana*, 0·1. The percentage of positive cases was 81·2; the protozoan index, 0·84; the helminth index, 1·05, and the total parasite index, 1·89. These totals are lower than those computed for Colombia (single examination) and Panama (2–3 examinations), and are higher than those for New Orleans (2–3 examinations) and Tennessee (single examination).

"The incidence of *Schistosoma mansoni* (12·2 per cent.), as indicated by this survey, is believed to constitute a fair estimate of this infection for Puerto Rico, although its actual distribution is 'spotted,' and depends on

factors which are essentially independent of those controlling the other parasites found on the Island."

[This is a continuation of the paper abstracted in Vol. 31, p. 777.]

C. L.

FAUST (Ernest Carroll) & HOFFMAN (William A.). **Studies on Schistosomiasis Mansoni in Puerto Rico. III. Biological Studies. 1. The Extra-Mammalian Phases of the Life Cycle.**—*Puerto Rico Jl. of Public Health & Trop. Med.* 1934. Sept. Vol. 10. No. 1. pp. 1–47. With 2 text figs. and 6 plates (1 coloured). [44 refs.] [Spanish version pp. 48–97.]

After mentioning the historical background and describing the methods used in the investigation, the life history of *S. mansoni* outside the definitive host is detailed and there are described 3 other cercariae found in the snail concerned, all new, under the names of *Cercaria neotropicalis*, *C. marini* and *C. paucispina*.

As to methods of staining, brilliant cresyl blue was used *intra vitam* for second generation sporocysts and for cercariae, while miracidia and cercariae after fixing in Bouin's fluid were stained with Bullock's haematoxylin.

Faecal eggs are most consistently viable in semiliquid stools passed during early stages of infection; but in such stools the enclosed embryo lives barely 24 hours at temperatures of 75° to 90°F. though in formed stools they survive for 2 or 3 days. In formed stools at 45° to 50°F. they live for a week or more with apparently unimpaired vitality. Urine is very toxic. Hatching is apparently caused by osmotic pressure produced by entry of water, and is slow, for most miracidia have not hatched after 16 hours in water. After throwing off the vitelline envelope the miracidia are found mostly in the top inch and bottom half inch of the water, and rarely survive for 24 hours.

The valid name of the Porto Rican intermediate host is, it is claimed, *Australorbis glabratus*, and not *Planorbis guadeloupensis*. As to the specific name, *guadeloupensis* Sowerby, 1821, must give place by priority to *glabratus* Say, 1818. As to the generic name, *Planorbis sensu stricto* applies only to European species, the American forms belong to *Helisoma* Swainson, 1840. But *Helisoma* has been divided into several sub-genera, of which *Planorbina* Dall, 1905 contained *glabratus*. But the subgeneric name *Planorbina* was preoccupied by HALDEMAN in 1842 so cannot be used for this group, and was therefore superseded by PILSBRY in 1934 by the name *Australorbis* which is held to require full generic rank, with *glabratus* as type. The anatomy of this snail is described. The miracidia attack the tentacles and head-foot organ. The earliest sporocysts were seen on the 8th day, they grow little till they have travelled to the lymph spaces round the digestive gland and reach 1 mm. in length on 12th to 15th days. Secondary sporocysts break out about 5 days later and cercariae from them have appeared by the 23rd day, bursting out as mature from the 22nd to 28th days and thereafter continuing to be discharged. In 4 snails the number of cercariae discharged after infection by a single miracidium varied between 75,000 and 210,000, the last snail still discharging 2,500 of them daily when the observation ended. There may be a high mortality among infected snails; indeed if the rupture in the tunica propria made by the cercariae is large the snail may bleed to death in a few minutes.

The sporocysts and cercariae are described, and it is insisted with the emphasis of italics that the latter have 6 pairs of glands, 2 anterior large granular and oxyphilic, and 4 posterior fine granular and basophilic. "It seems likely that observers who have failed to find the complete number of glands in mature cercariae have not been able to demonstrate one posterior pair which, on ventral or dorsal view, is almost always masked by another similar gland at this same level." This conclusion is supported by figures of glands in immature cercariae.

Cercariae escape from the snail between 9 a.m. and 2 p.m. They do not remain on the surface, and are easily transported by currents; 95 per cent. are alive after 24 hours, less than 10 per cent. after 30, which allows 2 middays for possible entry into man. *C. L.*

Eisbach (L.). De chirurgische beteekenis van de darmafwijkingen bij Bilharzia Mansoni in Suriname. [**The Surgical Manifestations of *S. mansoni* in Surinam.**]—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1934. Sept. 25. Vol. 74. No. 20. pp. 1261–1276. With 8 figs. on 4 plates. English summary.

The author's classification of these follows no fixed rule, being partly on pathological lines, partly on the site of lesions. Thus, he mentions three forms of colitis—catarrhal, sclerosing and polypoid—and a subperitoneal, omental and appendicular bilharziasis. Secondary infection may complicate the picture by causing further infiltration, abscess formation and perforation. In the sclerosing form treatment by enterostomy has proved successful. In spite of the frequency of this form of schistosomiasis in Surinam the author cannot find evidence that there are any grounds for the widespread belief that malignancy may develop as a complication of the lesions set up. The paper is illustrated by 8 excellent photographs of the associated pathological conditions. *H. H. S.*

Bourguignon (G. C.). Les réactions cellulaires tumorales dues à *Schistosoma mansoni* dans le grand epiploon de l'homme. [**Cellular Reaction in Swellings due to *S. mansoni* in the Great Omentum.**]—*Ann. Soc. Belge de Méd. Trop.* 1934. Sept. 30. Vol. 14. No. 3. pp. 257–261. With 6 figs. on 3 plates.

Surrounding eggs in the great omentum there occur pseudotubercles with fibroblasts, giant cells and an onion-like fibrosis. *C. L.*

Bequaert (J.). **The Molluscan Intermediate Host of the Blood Fluke, *Schistosoma japonicum* Katsurada, in the Philippines. With a Note on the Genus Blandfordia by** H. A. Pilsbury.—*Jl. Parasitology.* 1934. Sept. Vol. 20. No. 5. pp. 280–284.

Strong reasons are given for simplification of the nomenclature of the snails which carry *S. japonicum.*

Bequaert is forced to conclude that *Oncomelania hydrobiopsis* is a synonym of *Blandfordia quadrasi* and that *Oncomelania, Hypsobia, Hemibia* and *Katayama* are synonyms of *Blandfordia* A. Adams, 1863. He adds "It would seem that the smooth-shelled Oriental Amnicolidae known to act as intermediate hosts of the blood fluke, *Schistosoma japonicum*, such as *nosophora* Robson, *formosana* Pilsbry and Hirase, and *quadrasi* Möllendorff, should all be placed in the genus *Blandfordia.* The ribbed-shelled species, *hupensis* Gredler, may be

left in *Oncomelania*, if one wishes to retain that name in a generic or subgeneric sense." Pilsbry adds that, since *Katayama* is a synonym of *Blandfordia*, it appears that possible *Schistosoma* hosts occur over all Japan, since *Blandfordia* is found as far north as Yesso. *C. L.*

Li (Fu-ching). Beobachtung ueber die Biologie von Oncomelania, des Zwischenwirtes von *Schistosoma japonicum* in China. [**Biology of Oncomelania, the Intermediate Host in China of** *S. japonicum*.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1934. Dec. Vol. 38. No. 12. pp. 519–524. With 2 figs.

A note on the development of this snail and the conditions necessary for this, particularly the vegetation and the state of the bottom.

C. L.

Madras : **Ann. Adminis. Rep. of the Civil Veterinary Dept. for 1933–34** [Saunders (P. T.), Director].—55 pp. With 2 plates. 1934. Madras : Govt. Press.

Schistosomes in Pigs (p. 34).—This report suggests that in spite of conclusions to the contrary there is in India no schistosome parasitizing man. The ova in question probably came from pig's faeces.

" In the pig, hitherto, only one kind of schistosome, viz., *S. Japonicum*, Katsurada, 1904 has been recorded in the Far East, and the finding of this new species in the pig in Madras is of some interest. In 1906 Chandler, while working on the prevalence and epidemiology of hookworm and other helminthic infections in India, wrote a paper on a new schistosome infection in man. He saw schistosome ova in some samples of faeces collected from defaecation areas to which pigs had access in two villages in North Bengal. Chandler assumed the faeces from which he got the samples were passed by human beings, because of the nature of stools and the presence of ova of hookworms, Ascaris and Trichuris, but for obvious reasons, these facts do not prove the correctness of his assumption. Although nothing was known of the adults for convenience of reference, he named this apparently new species *Schistosoma incognitum*. The fact that these ova resemble those obtained in the schistosomes from pigs here, suggested the probability that the faeces in which he saw them were from pigs that had access to the defaecation areas and not from human beings. Up to the present time, there is no evidence to show that any new schistosome has been found in man in India other than those found in people after residing in endemic areas of *S. mansoni* and *S. haematobium*. Hence it is possible to assume that Chandler saw these ova in the sample of faeces of the pig, the adult of which has now been described and the name " Schistosoma suis " has been suggested for it."

[The description of *S. suis* does not appear in the report and has not been traced. For the reference to *S. incognitum* see this *Bulletin*, Vol. 24, p. 174.] *C. L.*

i. El Diwany (M. A. El Moneim). **Acriflavine for Schistosomiasis.** [Correspondence.]—*Lancet.* 1934. Sept. 8. pp. 571–572.

ii. Khalil (M.) & Salah (M.). **Treatment of Schistosomiasis with Acridine Compounds.**—*Ibid.* Oct. 20. pp. 862–863.

iii. Fisher (A. C.). **Acriflavine for Schistosomiasis.** [Correspondence.]—*Ibid.* Nov. 3. p. 1017.

iv. Khalil (M.). **Acriflavine for Schistosomiasis and Ankylostomiasis.** [Correspondence.]—*Ibid.* Nov. 24. p. 1193.

These reports follow Fisher's note on the treatment of schistosomiasis with acriflavine [this *Bulletin*, Vol. 31, p. 775].

i. A distinction is drawn between yellow trypaflavine with a formula of 3 : 6 diamino-10-methylacridine chloride, and brick-red acriflavine with one of 2 : 8 diamino-10-methylacridine chloride. Acriflavine has been used, and well borne, by mouth and anus. An editorial note points out that the two substances are identical, confusion having arisen because two systems of numbering have been adopted to indicate the positions of substituted groups in the acridine molecule. Variations in colour may be due to the fact that commercial samples consist of a mixture of varying proportions of the hydrochlorides of diamino-methyl-acrinidine-chloride and diamino-acridine.

ii. Fisher is stated to claim that schistosomiasis can be cured in 5 days by acriflavine, which is a synonym of trypaflavine. Treatment of 81 cases with acridine derivatives has shown no curative effect on either *S. haematobium* or *S. mansoni*. The treatment used consisted of : trypaflavine orally in solution or capsules, or intravenously ; diamino-methyl-acridine in capsules ; and atebrin in tablets by mouth. Erythema of the face with peeling was apt to occur, as did vomiting with the bigger doses (0·5 gm. daily) ; a few developed diarrhoea and a few collapsed. In 3 cases after 4 gm. of the drug a galactose liver test showed no impairment of function. Cercariae of *S. mansoni* lived for 3 hours in a trypaflavine solution in dilute serum.

iii. Fisher points out that Khalil's statement that he claimed cure in 39 of 52 cases is incorrect. Owing to the short observation period he was at pains to avoid any claim to a cure. It has been possible to keep 34 cases under observation for 3 to 6 months. Ova have reappeared in half, the other half are free from ova or symptoms. Most of the cases carried heavy infections. He is at a loss to explain the discrepancy between the two series.

iv. Khalil reports chemical analyses indicating that English preparations are the hydrochloride. Reports on 4 cases indicate that trypaflavine has no anthelmintic effect on ankylostomiasis [that is, the locality being Egypt, on ancylostomiasis]. *C. L.*

VAN NITSEN (R.). Traitement de la bilharziose intestinale par la fouadine concentrée. [**Treatment of Intestinal Schistosomiasis by Concentrated Fouadin.**]—*Bull. Méd. du Katanga.* 1934. Vol. 11. No. 4. pp. 123–124.

A calcium salt is concerned instead of a sodium one as in ordinary Fouadin, and 1 cc. contains 14·3 mgm. of antimony III [? trivalent] instead of 8·5 mgm. The injections at 24-hour intervals consisted of 1 cc., 2 cc. and thereafter 3 cc. In 13 cases eggs disappeared as follows :—after 1 and 2 injections, once each ; after 3, three times ; after 4, twice ; after 5, twice ; after 6, four times ; after 9, once. Abdominal pain and bloody stools were the rule after treatment began. *C. L.*

SALAH (M.) & HASSAN (A.). **The Action of Antimony on the Liver with Special Reference to its Use in the Treatment of Schistosomiasis.**—*Arch. f. Schiffs- u. Trop.-Hyg.* 1935. Jan. Vol. 39. No. 1. pp. 1–14. [31 refs.]

In bilharzial cases antimony does not damage but rather improves liver function.

Cases were treated either with fouadin or tartar emetic. As to fouadin, a man of 60 kgm. received as first dose 3·5 cc. and thereafter 5 cc. ; the first 3 injections given daily, the rest every other day ; the course covering 9 injections, or more if eggs had not by then disappeared. Tartar emetic was given similarly, the first dose being 1 cc. of a 6 per cent. solution, the others 2 cc.

Of 23 cases with clinically normal livers, 8 showed disturbed liver function, mainly glycogenic, before treatment and only 2 after it. Of 20 cases with clinically enlarged or cirrhotic livers, 7 showed positive galactose tests before treatment and only 3 after it.

Of 28 cases of jaundice, 15 of whom had a previous history of a tartar emetic course, 22 cases were improved or cured ; 19 of them had active schistosomiasis, and the rate and degree of improvement were greater in the bilharzial than in the non-bilharzial group. Accordingly it is concluded that antimony had not disturbed liver function in these cases ; nor in 6 followed for varying periods up to one year was there any evidence of delayed action. *C. L.*

Barneoud (Jean). Le traitement de la bilharziose vésicale par le Dn 7 et le Dn 18. [**Treatment of Vesical Schistosomiasis by Dn 7 and Dn 18.**]—*Bruxelles-Méd.* 1934. Dec. 9. Vol. 15. No. 6. pp. 166–170.

These trivalent antimonials have produced excellent parasiticidal effects on *S. haematobium*.

Five patients were treated with Dn 7 and 8 with Dn 18. In all of them repeated examinations over 3 months have shown absence of eggs. The sequelae have been cough and vomiting and are spoken of as very rare and very benign. A case is, however, mentioned, apart from these 13, in which intravenous injection of 0·4 gm. of Dn 18 produced laryngeal spasm, with sensations of constriction of the chest and suffocation, and with a small pulse of 120 ; gluteal intramuscular injection of 0·15 gm. of Dn 7 produced local pain and trouble in walking, and intravenous injection of the same produced vertigo with cold sweat, cough, vomiting and rapid pulse, so that the treatment was abandoned. The doses advised for Dn 7 are of 0·25 gm. first every other day and then daily intravenously with a total varying from 3 to 4·15 gm. ; of Dn 18 the doses are 0·4 gm. with a total of 3 to 5·6 gm. over an average period of 15 days. The drugs are produced by the Union Chimique Belge. *C. L.*

Cawston (F. G.). **Evidence of the Successful Destruction of Schistosomes.**—*Parasitology*. 1934. Oct. Vol. 26. No. 4. pp. 460–462.

Absence of eggs does not imply absence of or cure of schistosome infection.

Cawston returns to the persistence of male parasites after treatment which has killed females, or the possibility of a slow development of the latter, and points out the likelihood of missing faecal or even urinary ova. He draws attention to complement fixation tests and to persistent eosinophilia or a rise in its incidence during treatment as indicating

presence of parasites. He suggests that shoulder pains are hepatic in origin and that investigation is needed to determine whether they are antimonial in origin or due to poisoning of parasites. *C. L.*

i. Oesterlin (M.). Zur Chemotherapie der experimentellen Schistosomiasis. [**Chemotherapy of** *S. mansoni* **and Opisthorchis Infection.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1934. Oct. Vol. 38. No. 10. pp. 433–441. [19 refs.]

ii. ——. Zur Chemotherapie des Katzen-Leberegels (*Opisthorchis felineus*).—*Ibid.* pp. 441–445. [13 refs.]

i. Experiments on mice suggest the discovery of a new drug active against *S. mansoni*.

Sixteen drugs were tested and of these Sdt. 386 B gave promising results. It is a brown powder containing 18 per cent. of arsenic and 20 per cent. of antimony, and was used in a dose of 0·15 gm. per kgm. As to the transference of results to man it is necessary to add that in these mice tartar emetic was of little value. Other drugs proved valuable vermicides but unfortunately too little selective, killing tissues at the site of injection. The value of Sdt. 386 B was confirmed on a monkey.

ii. Sdt. 386 B. proved effective in opisthorchis infection of cats in a dose of 20 mgm. per kg. *C. L.*

Hassan (A.) & Betashe (M.). *Fasciola gigantica*, **an Antigen for the Skin Reaction in Human Schistosomiasis.**—*Jl. Egyptian Med. Assoc.* 1934. Dec. Vol. 17. No. 12. pp. 991–993.

Antigen from *Fasciola gigantica* tested in 130 patients passing schistosome eggs gave no intradermal reaction in 6, wheals up to 12 mm. in diameter in 20, and wheals from 13 to 25 mm. or more in diameter, mainly with pseudopods, in 104.

The antigen needs careful preparation. Fresh worms are thoroughly washed, quickly dried with filter paper, spread on glass, and dried in a vacuum desiccator. Two grams of the dried and powdered worms and 100 cc. of petroleum ether (B.P. 30–50 c.) in a stoppered flask are kept in an ice-box for 24 hours with occasional shaking. After filtering, the dry powder is extracted with dry ether for 12 hours in a Soxhlet apparatus. After removal of the ether, the powder is dried in an incubator and 0·5 gm. is emulsified in a mortar with 100 cc. of a phosphate buffer solution of pH 7·4, containing 0·5 per cent. NaCl and 0·4 per cent. carbolic acid. The emulsion is put in a shaking machine in "slow motion" for 30 minutes, left in the ice-box with occasional shaking for 4 hours, centrifuged for 10 minutes "at a high speed" which makes easier the subsequent passage of the fluid portion through a Seitz filter. The filtrate is stored in the ice-box after testing its sterility. The amount injected is 0·02 cc. Large quantities of the extract can be made at a time. *C. L.*

Lièvre (H.). Données expérimentales sur les agents thérapeutiques de la distomatose à *Fasciola hepatica*. [**Experiments on Remedies for** *F. hepatica* **Infestation.**]—*Ann. Parasit. Humaine et Comparée.* 1934. Nov. 1. Vol. 12. No. 6. pp. 511–520. [21 refs.]

The dye, Magdala rose, injected intravenously in a 1 per cent. solution is excreted rapidly, and apparently exclusively, in the bile, and has proved in the author's hands an excellent fasciolicide. *C. L.*

i. Uyeno (Hiroshi). Ueber pathologisch-histologische Veränderungen der Kaninchenniere bei experimenteller Clonorchiasis sinensis. [**Histological Changes and Uric Acid Decomposition in Rabbit Kidney in** *C. sinensis* **Infection.**]—*Okayama-Igakkai-Zasshi.* (*Mitt. d. Med. Gesellsch. z. Okayama*). 1934. Apr. Vol. 46. No. 4. [In Japanese pp. 794–801. [14 refs.] : German summary p. 793.]

ii. ——. Ueber den urikolytischen Vorgang in der Kaninchenniere bei experimenteller Clonorchiasis sinensis.—*Ibid.* June. No. 6. [In Japanese pp. 1225–1230. [23 refs.] German summary p. 1224.]

i. The changes dealt with are those in the kidneys, namely, cloudy swelling in acute cases and granular degeneration in chronic; they are most marked in the convoluted tubes and are caused partly by parasitic poisons and partly are the result of lesions in the liver.

ii. In clonorchis-infected rabbits the splitting up of uric acid by the kidney is greatly lessened as compared with the condition in the uninfected. *C. L.*

Vogel (Hans.). Der Entwicklungszyklus von *Opisthorchis felineus* (Riv.) nebst Bemerkungen ueber die Systematik und Epidemiologie. [**Developmental Cycle of** *O. felineus.* **Classification: Epidemiology.**]—*Zoologica.* Heft 86. Bd. 33. Lieferung 2/3. pp. 1–103. With 45 text figs. & 8 plates (1 coloured).

This beautiful monograph deals with investigations and experiments on the morphology and biology of *Opisthorchis felineus* from egg to adult, with certain systematic questions, and with the distribution and epidemiology of the infection.

Briefly the only snail found in East Prussia to act as first intermediate host was *Bithynia leachi* Shepp. Even *B. tentaculata* failed to do so. The miracidium fully formed in the egg as passed is hatched by the osmotic pressure of the juices in the snail's alimentary canal, and not by water; indeed when freed from the shell it is killed by water in a few minutes. The sporocyst develops close to the end of the intestine and reaches in 1 month a length of 1·2 to 1·85 mm. and the rediae then begin to leave it. Immature cercariae leave the rediae and reach maturity in about 2 months from the date of infection. They leave the snail during daylight, mostly between noon and 4 p.m., are tobacco-pipe shaped with a membrane on the tail, have a positive phototaxy and geotaxy, and are activated by agitation and a change in the amount of light falling on them.

The second intermediate hosts are the fish *Tinca tinca* and *Idus melanotus*, bottom feeders. When in contact with them the cercariae penetrate within 15 minutes and within 24 hours have begun to encyst either in the muscles of the body or the connective tissue of the head. These metacercariae grow to 3 or 4 times the original size and at a temperature of 18° to 20°C. are ripe and capable of infecting the definitive host. When the fish is eaten by this, the cysts pass the stomach unaffected, but are freed within 20 to 90 seconds of coming into contact with the juice from a fistula of the small intestine. Bile attracts the young flukes, and they travel up the bile duct into the liver within 5 hours of being swallowed. Maturity is reached, as a minimum, 4 to 4½ months after the egg left the last definitive host. *C. L.*

ERHARDT (Albert). Die Verbreitung von *Opisthorchis felineus* (Riv.) und anderen Katzenhelminthen in Ostpreussen. [**Distribution of** *O. felineus* **in E. Prussia.**]—*Ztschr. f. Parasitenk.* 1934. Sept. 18. Vol. 7. No. 1. pp. 121–124. With 1 fig.

On the eastern shore of the Kurisches Haff in East Prussia 87·8 per cent. of the cats harbour *O. felineus*. Most have more than 100 worms and some about 1,000. *C. L.*

EICHHOLTZ (F.) & ERHARDT (A.). Wirkungsbedingungen des Fuadins bei der Opisthorchiasis der Katze (Kombinationen mit Emetin, Wismut und Quecksilber). [**Conditions of Action of Fouadin in Opisthorchiasis of Cats.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1934. Dec. Vol. 38. No. 12. pp. 524–534. [20 refs.]

The results of experiments on cats infected with opisthorchis, and treated with fouadin alone and in combination were not particularly satisfactory.

Fouadin in dosage of 0·1 cc. per kilo. was given to 24 naturally infected cats. In 14 of them 80 to 100 per cent. of the trematodes were killed, the others became fouadin-fast ; in those in which deworming was not effected, egg laying was inhibited for 2 to 3 weeks. Emetine had but slight effect. When these two drugs were combined the latter annulled the action of the former. Bismuth and mercury were ineffective. The action of fouadin is impaired by a bad general state, by degeneration in the liver, and by other remedies given with it.

C. L.

WATANABE (Masumi). Beiträge zur Kenntnis des *Paragonimus westermanni*. (I. Mitteilung.) Ueber die Paragonimus-cyste in *Eriocheir japonicus*. [**Paragonimus Cysts in** *Eriocheir japonicus*.] —*Okayama Igakkai Zasshi* (*Mitt. d. Med. Gesellsch. z. Okayama*). 1934. July. Vol. 46. No. 7. pp. 1514–1532. With 24 figs. on 1 plate. [20 refs.] [In Japanese. German summary pp. 1514–1515.]

Watanabe's investigations on paragonimus cysts in their second intermediate hosts lead him to these conclusions.

In the Okayama Prefecture, as YOSHIDA is stated to have shown already, these cysts are found in 50 to 92 per cent. of *Eriocheir japonicus* and 2 to 7 per cent. of *Potamon dehaani*. Immature cysts have a single transparent cyst wall which is digested in artificial gastric juice, yet one in nine can infect dogs ; mature cysts are double walled and contain a shrunken, fully developed larva ; yet the walls of cysts of all ages may be so brown as to hide the embryo. Cysts are found in the muscles and in the epithelium and blood vessels of the gut, or in the gut itself ; and it is by the blood vessels that they mainly reach this viscus. They never leave the crab but at temperatures of 16° to 23°C. may live, in its dead body, in quietly running water for six weeks and for 10 to 30 days after being freed from this. [If the descriptions of the figures had been accompanied by a translation in a European language, their value would have been increased.] *C. L.*

Bercovitz (Z.) & Rogers (J. M.). *Paragonimus westermani.* **Report of Case presenting Abdominal Involvement.**—*Puerto Rico Jl. Public Health & Trop. Med.* 1934. June. Vol. 9. No. 4. pp. 492–496. With 1 plate. [Spanish version pp. 497–501.]

From Southern Korea is reported the case of a woman of 29 who had *P. westermanii* ova in sputum and abdomen.

Haemoptysis began in 1922; ovarian cysts removed in 1926 and 1929; abdomen contained 16 litres of bloody fluid, and when opened the peritoneum was studded with blebs or excrescences. In certain mesenteric lymph glands the ova were found in groups in the marginal sinuses, others being free of them. No worms were found in any part of the removed tissue. *C. L.*

Tarassow (Wiktor). Beiträge zum Problem des Kampfes gegen *Diphyllobothrium latum* in Nord-Westgebiet. 2. Mitteilung. [**Campaign against** *D. latum* **in North-West Russia.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1934. Nov. Vol. 38. No. 11. pp. 477–486. With 1 fig. [23 refs.]

A continuation of the description of the campaign (see Petruschewsky & Tarassow, this *Bulletin*, Vol. 30, p. 680) shows the high percentage of broadworm infection in Karelia and about Leningrad.

The district about Leningrad with its many stretches of water is particularly heavily infected—reaching as much as 80 per cent. of inhabitants of certain parts. In 1,560 persons tabulated, the average percentage of infection was 37·1. After a treatment campaign the village percentages lay between 7·4 and 10·98. Of 405 individual strobiles the average length was between 8 and 9 metres, but in a case harbouring 143 parasites the total length of all was only 117 metres.

C. L.

Palais (M.). Résistance des rats à l'infestation d'*Hymenolepis diminuta* (Rud.). [**Resistance of Rats to Re-infestation by** *H. diminuta.*]—*C. R. Soc. Biol.* 1934. Vol. 117. No. 36. pp. 1016–1017.

The experiments lead to the conclusion that rats infected with *H. diminuta* are resistant to an added infection.

Tenebrio molitor bred in the laboratory were infected by being fed on ripe segments of *H. diminuta*. Some were then fed to 3 rats born and bred in the laboratory. A month later they were passing onchospheres. To them and to two others were fed more *T. molitor* which, as dissection showed, were still infective. Six days later all 5 were killed. The two which had one infected feed contained 34 and 112 young *H. diminuta* measuring 6 to 35 mm. in good extension, all immature. The three who had two infective feeds contained 4, 6 and 9 strobiles measuring in good extension 130 to 660 mm. (average 240 mm.) the posterior rings being mature and ova being present in the faeces; there were no worms corresponding to the second infective feed. Protection from added infection had been produced by as few as 4 worms. *C. L.*

i. NARIHARA (N.). **Form and Colour of the Egg and Mode of its Release from the Gravid Proglottids of the Rat Tapeworm,** *Hymenolepis diminuta* **(Rudolphi).**—*Taiwan Igakkai Zasshi* (*Jl. Med. Assoc. Formosa*), 1934. Nov. Vol. 33. No. 11 (356). [In Japanese pp. 1611–1622. With 2 figs. [33 refs.] English summary pp. 147–148.]

ii. ——. **On the Resistance of the Egg of** *Hymenolepis diminuta.*—*Ibid.* [In Japanese pp. 1636–1646. [31 refs.] English summary pp. 148–149.]

i. The " egg's " dimensions are given to six places of decimals.

ii. Dried " eggs " on glass at 20·3° to 23·5° lived for 7 days, freed eggs in water at the same temperature for 25 and eggs in segments for 29 days, eggs in normal saline lived for a month and in 10 per cent. salt solution for 20 days. Immersion in the following solutions allowed survival in minutes for the intervals noted, the solution being of 10 per cent. unless otherwise noted : caustic potash 10, hydrochloric acid 45, sulphuric acid 15, 1 per cent. corrosive sublimate for 50 minutes in the case of some eggs, 90 per cent. alcohol 1 hour, kresol 1 hour, lysol a few eggs for 40 minutes, formalin 3 hours, urine 1 month if not changed. A moment's immersion in water at 60°C. killed them. *C. L.*

NORONHA (A. J.). **A Case of** *Hymenolepis nana* **Infection.**—*Jl. Trop. Med. & Hyg.* 1934. Nov. 1. Vol. 37. No. 21. pp. 325–326. With 3 figs.

This case of *H. nana* infection was discovered when the stool was examined to determine the sort of dysentery from which the patient suffered. Onchospheres of the worm were found and after an anthelmintic some 50 worms were collected, 2 having heads. Thereafter the man's dysentery ceased. This is the first case disclosed in the Pathological Laboratory of the B. J. Medical School, Poona, during the author's experience of 13 years, and is believed to be perhaps the first to be reported from Poona. [CHANDLER (this *Bulletin*, Vol. 24, p. 1003) lists the incidence of this infection in 84 cases examined in Poona as 2·4 per cent.] *C. L.*

BARNETT (Louis). **The Incidence of Hydatid Disease in New Zealand.**—*New Zealand Med. Jl.* 1934. Aug. Vol. 33. No. 176. pp. 191–196.

Hydatid disease is increasing in New Zealand.

" From the collective statistics that I have gathered together and set forth in this paper, the following conclusions can be drawn. They give food for reflection and clearly call for a more intensive prophylaxis against hydatid infection.

" 1. That hydatid disease is increasing somewhat in New Zealand. Including cases seen in private practice, a reasonable estimate is that from 100 to 150 cases are occurring every year, with a mortality of about 15 per cent.

" 2. That hydatid infection is far more common in the Canterbury district than anywhere else in New Zealand. The Otago district formerly held this unenviable distinction, and now comes second on the list.

" 3. That an increasing number of cases are being treated in the smaller hospitals of the Dominion." *C. L.*

RILEY (William A.). **Reservoirs of Echinococcus in Minnesota.**—Reprinted from *Minnesota Med.* 1933. Dec. Vol. 16. p. 744.

Hydatid cysts have been found in 6 of 13 moose examined and the adult worms in 2 of 3 timber wolves.

Since about 450 cases of hydatid have been reported from man in Canada and the United States, M. C. HALL, chief of the Zoological Division of the Federal Bureau of Animal Industry, Washington, answered Riley's query by informing him that the strobiles had not been found there except in animals deliberately infected. Accordingly moose and wolves were examined with the results noted above.

C. L.

FENG (H. H.). **Cysticercus cellulosae Subconjunctivalis. Report of a Case.**—*Chinese Med Jl.* 1934. Sept. Vol. 48. No. 9. pp. 863–868. With 3 figs. on 2 plates. [21 refs.]

A solitary cysticercus under the conjunctiva near the inner canthus of the right eye.

The cyst measured 6 × 4 × 2 mm. and had been noticed for a week. There was an eosinophilia of 11 per cent. It is the first case of ocular cysticercosis found in 33,000 eye patients at the Peiping Union Medical College during the last 12 years. That it was so, was established by sections which showed a rostellum with large and small hooklets, and suckers. No dense white granule showed through the cyst wall. There were no other evident cysts nor symptoms suggesting them.

C. L.

MILLER (Harry M.), Jr. & GARDINER (Margaret L.). **Further Studies on Passive Immunity to a Metazoan Parasite,** *Cysticercus fasciolaris.*—*Amer. Jl. Hyg.* 1934. Sept. Vol. 20. No. 2. pp. 424–431.

In the transmission of passive immunity to *C. fasciolaris* the following 3 points have been established from results unpublished, previously published, and here published.

" The rat can be immunized actively against infection with the onchospheres of *Taenia taeniaeformis* and can be protected against infection by passive transfer of serum from immune animals. It has further been demonstrated that immune serum can inhibit early infections if administered within ten days." *C. L.*

DE WAELE (A.). Etude de la fonction biliaire dans le phénomène de l'évagination chez les cysticerques des cestodes. [**Function of Bile in Evagination of Cysticerci.**]—*Ann. Parasit. Humaine et Comparée.* 1934. Nov. 1. Vol. 12. No. 6. pp. 492–510. With 1 fig.

The bile salts and, secondarily, choline, produce rapid evagination of the scolex of *Cysticercus pisiformis* the larva of *Taenia serrata*, and active movements of suckers and rostellum, and so presumably favour attachment to the intestinal mucosa. *C. L.*

Freund (L.). Helminthenwanderungen. III. Teil: Die Wanderungen der Cestoden von Wirt zu Wirt und im Wirtskörper. [**The Wanderings of Cestodes.**]—*Ztschr. f. Parasitenk.* 1934. July 21. Vol. 6. No. 5. pp. 592–602. With 1 fig. [19 refs.]

In continuation of previous papers [this *Bulletin*, Vol. 31, p. 373] the wanderings of cestodes in the hosts are considered. *C. L.*

Walandouw (E. K.). Nematoden als bestrijders van anopheles larven. [**Nematodes as Enemies of Anopheles Larvae.**]—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1934. Sept. 11. Vol. 74. No. 19. pp. 1219–1224. With 3 figs. on 2 plates. English summary (9 lines).

"Description of a nematode parasitic in the larvae of a variety of *Anopheles leucosphyrus*.

"The worm is found freely moving as larva or adult outside the intestine in the body cavity of the anopheles larva. After some time the adult worm bores through the wall of the thorax or the abdomen. After the worm has come out, the anopheles-larva dies. The worm now eats the dead larva. The colour of the worm is milky white; the length is 17–20 millimeter, the width 0·052–0·088 mm.; the mouth has a spear, no teeth; the back-part ends in a tail of 0·044–0·088 millimeter."

A fuller description of the worm will be published. *C. L.*

Lee (Yin). Ueber Askarideninfektion und ihre Bekämpfung. [**Ascariasis in China and its Prevention.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1934. Sept. Vol. 38. No. 9. pp. 390–394. [10 refs.]

The paper deals with the examination of 3,118 stools in Shanghai of which one-third showed ascaris eggs. The ascaris-infected are dealt with.

The largest number of worms recovered was 54. There are dealt with symptoms, and diagnosis from stool examination which will disclose females. Under treatment are considered santonin, chenopodium with an immediate aperient, helminal, chrysemine, hexylresorcinol and rotylon. The last has been used in 50 cases but the anthelmintic results are not clear; 10 cases certainly needed retreatment. Prophylaxis concerns itself solely with swallowed eggs, associated in China with the use of human faeces as manure. Ascariasis should be combated by treatment of school children and by the proper cooking of vegetables. *C. L.*

Lossev (L.). [**The Dehelminthization of the Surrounding Medium in Ascaridiosis.**]—*Med. Parasit. & Parasitic Dis.* Moscow. 1934. Vol. 3. No. 2. [In Russian pp. 185–191.]

The effects of high temperatures on the eggs of equine and canine ascarids are much as in the human form. Exposure to 50°C. up to one hour had no effect upon the unsegmented eggs of *Parascaris equorum*, while at 40°C. the majority were killed after 3 hours. Temperatures from 60 to 100°C. destroyed the eggs in one minute. Eggs of *P. equorum* and *Toxocara canis* containing motile embryos proved to be more resistant to high temperatures: exposure to 60°C. up to 3 minutes did not destroy the larvae immediately, but caused injuries leading to their death after several days.

Various solutions of sulphuric acid, iodine, corrosive sublimate, potassium permanganate and slaked lime failed to destroy the eggs of the ascarids, but 4 per cent. carbolic acid and quicklime killed them immediately. *C. A. Hoare.*

Girges (Rameses). **Pathology and Complications of Ascariasis.**—*Jl. Trop. Med. & Hyg.* 1934. Oct. 1. Vol. 37. No. 19. pp. 296–300.

The pathology concerns itself with catarrh of stomach and intestine and with peri-intestinal inflammation. The complications are intestinal obstruction, intussusception, volvulus and sinus, abdominal tumours, appendicitis and its stimulation, diverticulitis, perforation, peritonitis, abscess, pancreatitis, biliary accidents, liver abscess and certain rare conditions. *C. L.*

Girges (Rameses). **Pathogenesis of Ascariasis.**—*Jl. Trop. Med. & Hyg.* 1934. Nov. 15. Vol. 37. No. 22. pp. 340–343.

Girges deals with the hatching and transmigrations of ascaris larvae and the lesions they cause. The last reference quoted is in 1930. His indebtedness to this *Bulletin* is acknowledged. *C. L.*

Tsuji (Haruo). Wirkung des Torilols, eines wirksamen Bestandteils der Früchte von *Torilis anthriscus*, Gmel., einem japanischen Volksmittel gegen Askariden. [**Action of Torilol from the Fruit of *Torilis anthriscus*, a Popular Remedy in Japan against Ascarids.**]—*Tohoku Jl. Experim. Med.* 1934. Sept. 28. Vol. 24. Nos. 1 & 2. pp. 174–194. With 3 figs.

An investigation of a fruit which is in domestic use in Japan against ascaris.

The active helminthological principle is torilol, a yellowish brown, transparent, viscid fluid with a somewhat aromatic smell and bitter taste, readily soluble in water. In earthworms, leeches and ascaris larvae it first irritates and then paralyses movements, and in the last a 1 per cent. solution produces complete paralysis in 3 hours. The minimum lethal dose by mouth per kilo. is for frogs 8 gm. and for mice 30 gm. In rabbits 1 gm, per kilo. produces no obvious change. Its clinical possibilities require investigation. *C. L.*

Faz Tabío (Humberto). Nota clinica a proposito de un caso de ascaridiosis aberrante. [**A Case of Aberrant Ascaris.**]—*Vida Nueva.* 1934. July. Vol. 8. No. 1. pp. 25–29.

The patient was a boy of 4½ years of age who had complained for several days of pain in the abdomen (epigastric region), with loss of appetite and much meteorism. Having had an attack of vomiting and a marked exacerbation of the pain he was brought to hospital and while being examined there the umbilicus was observed to be prominent and a worm made its appearance through the cicatrix and its extrusion was assisted by traction. Five minutes later a second appeared and a quarter of an hour afterwards a third. All were female ascarides. There must have been a perforation of the bowel and a local peritonitis with adhesions to the abominal wall and a fistula through which the worms passed. No operation was undertaken and recovery was uneventful, healing taking place in a few days. *H. H. S.*

KELLER (A. E.). **A Comparison of the Efficiency of the Stoll Egg-Counting Technique with the Simple Smear Method in the Diagnosis of Hookworm.**—*Amer. Jl. Hyg.* 1934. Sept. Vol. 20. No. 2. pp. 307–316.

" These data show that the dilution egg-counting technique is more accurate than the smear method for this series of examinations."

The Stoll-Hausheer method was used, that is 1/200 gram of faeces under a cover slip 25 mm. square. The smear was apparently a squash preparation of stirred faeces, an amount being used which allowed " small print " to be read when it was spread under a cover of the same size. Of 2,412 specimens examined by each method, the positive percentage results were : at the first examination 42·2 for dilution and 35·1 for smear, and after the second 44·0 and 39·4 respectively. Of specimens positive to either method 93·6 per cent. were displayed by dilution and 83·9 per cent. by the smear. The accuracy of these smears increased with the faecal egg content. By this series " the lowest level of intensity of infestation at which, for practical purposes, the smear will be of value in diagnosing hookworm infestation would be 1,200 eggs per gram of faeces instead of 600 eggs per gram as indicated by Herrick and Hausheer." It was naturally found that the number of eggs counted per smear was as feasible a method of measuring the intensity of infection as was that disclosed by dilution. These figures are also displayed as presumed worm loads. *C. L.*

KENDRICK (J. F.). **The Length of Life and the Rate of Loss of the Hookworms,** *Ancylostoma duodenale* **and** *Necator americanus.*—*Amer. Jl. Trop. Med.* 1934. Sept. Vol. 14. No. 5. pp. 363–379. With 9 charts.

A model of forethought, execution and control in work carried on over 7 years on the egg production and longevity of the two common hookworms of man.

As to controls, the sanitary condition of the jail, the Madras Penitentiary, in which the work was done, appeared to exclude natural infection ; but to make certain 238 prisoners, who were by D.C.F. either found to be free from hookworm infection or were treated till this was so, were re-examined by this technique at first monthly and then quarterly, and in none of them were ova discovered during the continuance of the simultaneous investigation on 30 clean prisoners who volunteered for the undergoing of deliberate infection. Both sets of men lived and worked in like conditions.

Since ancylostomes and necators are both present here and their longevity had to be separately investigated, larvae, pure specifically, were obtained by expressing ova from females of the species to be used and culturing them on sterile soil or sand. The concentration of larvae in a given suspension was evidently determined and a quantity of suspension, generally containing about 200 of them, was either placed on moist sand on the skin or given in hard gelatine capsules by mouth, it being determined that these containers dissolved in tap water in less than 20 minutes. Five oral infections were attempted with necators, a dosage of 200 larvae being given 2 to 4 times. Repeated D.C.F. examinations failed to show ova in any of them although the larvae were vigorous and their fellows produced skin infections. The other 5 necator and 20 ancylostome infections were produced through the skin. Ground itch followed at once and laryngeal irritation from the

5th day, most marked between the eighth and fifteenth days and in 2 cases persisting for over a month. Baermann's apparatus recovered larvae from the sputum of all those tested (those with the worst coughs) and in one case the numbers collected and the fact that intestinal infection failed, suggested that expectoration may be a factor in limiting this. Actually the percentage of ancylostome larvae which was accounted for as adults, recovered after anthelmintics pushed to deworming as evidenced by D.C.F., varied from one seven months after infection to about 100 eleven months after this.

Of the ancylostome infections 3 were able to be followed to their natural elimination. The intervals between infection and disappearance of eggs to D.C.F. were 81, 78 and 68 (average 76) months, whereas to the Stoll-Tseng egg counting method they were shorter by about 1 to 3 years. Similarly in the one necator case followed throughout infection lasted 61 months, but had reliance to determine this been placed on the Stoll method it would have been placed as 12 months, some 4 years too short. The counts themselves show that in ancylostome cases there is a steady rise in egg output to a peak reached 15 to 18 months after infection and thereafter a rapid decline in 3 to 6 months amounting to 50 or 70 per cent. In general the necator infections followed the same course. [This investigation had of course to leave it an open question whether this delayed reaching of the apex of egg production was due to slowness of individual worms to reach full egg laying power (in which case worm-egg ratios become more illusive than ever) or to strayed larvae slowly arriving at and maturing in the gut. Moreover it is interesting to recall that in Looss's experimental infection of a man with ancylostome larvae the greatest mean number recorded was in the 29th month, just before Looss lost sight of him.] The differences in the percentages of larvae reaching adult life could not be correlated with age—nor with previous infection since this was not known. Deaths, releases and transfers over which Kendrick had no control reduced the numbers lamentably during the course of the experiment. *C. L.*

Foster (A. O.) & Landsberg (J. W.). **The Nature and Cause of Hookworm Anemia.**—*Amer. Jl. Hyg.* 1934. Sept. Vol. 20. No. 2. pp. 259–290. With 6 graphs. [26 refs.]

"We have shown that it is *unnecessary* to postulate a toxin to account for the anemia of hookworm disease in dogs. . . . The data are in full agreement with the hypothesis that the anemia of hookworm disease is of a purely hemorrhagic nature."

The investigation was on dogs deliberately infected with *A. caninum* and bled at intervals. The first appearance of eggs was determined by D.C.F., and their numbers, when these had sufficiently increased, by the Stoll-Hausheer method. Blood samples were taken by cardiac puncture. The data are confined to the circulating part of the erythron, the marrow having been examined in no case. Five dogs were bled at intervals over periods varying from 20 to 319 days; 4 of them were already lightly hookworm infected, one was uninfected; the total amount of blood removed varied from $\frac{1}{8}$ to $1\frac{1}{4}$ of the body weight. The drop in haemoglobin was greatest in the uninfected dog (67 per cent.), from which about $\frac{1}{8}$ of its body weight of blood had been removed by 23 bleedings over 62 days [perhaps an indication that already hypertrophied red marrow in the infected cases was able to

meet the immediate attack]. " By subjecting dogs to periodic bleeding it has been possible to determine the absolute blood loss necessary to produce certain degrees of severe anaemia." [Yet the average daily abstraction of blood to the extent of 0·423 and 0·645 per cent. of the body weight produced respective drops of haemoglobin of 59·7 and 48·5.]

Although the fact of blood loss caused by worms is accepted and there is quoted the work of WELLS [this *Bulletin*, Vol. 29, p. 421] which puts the daily loss of blood caused by the individual worm as 0·8 cc. and that of NISHI [this *Bulletin*, Vol. 30, p. 686] which puts it as up to 0·484 and 0·7 cc., the authors quite arbitrarily put the figure at 0·1 cc. holding that accepting the former figures the number of worms which could produce an anaemia corresponding to the effects of bleedings is " ridiculously small," and they tabulate the number of parasitizing worms according to this assumption. Even so " it is still apparent that the blood loss caused by hookworms is a factor entirely sufficient in itself to account for the anaemia of hookworm disease in dogs." Careful tabulated work confirms the general conclusion that hookworm anaemia is microcytic and hypochromic. Nevertheless, when dogs were throughout treated with iron, cobalt and copper (2·28 gm. daily of a mixture of iron citrate 100, copper sulphate 1, cobalt chloride 5) and were given 100 larvae orally when 156 days old, the anaemia they developed was not microcytic.

Two other groups of experiments are detailed which show that there is no essential difference between the anaemias of bleeding and of hookworm infection. The authors twice refer to the inverse relationship between the number of eggs passed and the haemoglobin level, and seem disposed to consider that a rise in that level induces a resistance to the worms. Others are probably more likely to believe that death among the parasites enables the hypertrophied haemopoietic portion of the erythron to get level with the lessened blood loss. The same consideration, which is so long and well established for human infection, will explain the authors' surprise at finding how nearly the blood picture of infected dogs approaches to the normal of their never-infected litter mates.

The effects of iron therapy in producing rapid and astonishing improvement in the blood picture and almost certainly in saving life in heavily infected cases are displayed, so that " it is impossible for us to reconcile these spectacular responses to iron with the postulation that the anaemia of these dogs was caused by a toxin which paralyzed the hemopoietic centres. . . . It is our opinion that the acceptance of the hypothesis that long continued bleeding may, as an end result, cause failure of the hemopoiesis and aplasia, makes it possible to visualise nearly all of the pathology and symptomatology of hookworm disease as the complex result of chronic blood loss." *C. L.*

DE LANGEN (C. D.). **The Origin of the Anaemia in Ankylostomiasis.**—*Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1934. Vol. 23. Nos. 2 & 3. pp. 135–157.

" Loss of blood, diet and the condition of the intestinal canal work together in bringing about this severe and remarkable anaemia. Further investigation must teach us whether there is also a toxic damaging of the bone marrow involved in addition to these factors."

de Langen returns to this subject (this *Bulletin*, Vol. 30, pp. 686, 812) and a comparison of the paragraph quoted above with that which ends the abstract first noted will indicate that the outline (and often the words of this paper) have been used by him before.

Loss of blood from the alimentary canal, as indicated by the benzidine reaction, is shown to be greater in those who are at work than in those confined to bed. As to eosinophilia it is shown by comparison of some 500 blood examinations that the severer the anaemia the fewer the eosinophils. " An eosinophilia is always reported as forming part of the blood picture of hookworm anaemia." [In fact ASHFORD *et al* (1911 quoting 1902) showed that in the worst cases it was absent, and that it was more useful for prognosis than diagnosis.] From this and from platelet counts it is deduced that wandering larvae are largely concerned in its production. The toxin theory of the anaemia is still without any experimental confirmation ; though clinically it is held to be confirmed by the peculiar orange tint, which in S. America gives the infection the name of " the yellow sickness," a hypertrophy and dilatation of the *left* ventricle, a low diastolic and often systolic pressure, weakening of the endocrine system evidenced by lack of growth, anisocytosis and poikilocytosis in grave cases, and a megaloblastic degeneration in the last stage. Under haemolysis and regeneration the examination of 2 more cases (7 in all) sets the average life of the red cell in hookworm infection as 265 days as against 209 days for the normal native. The influences of diet on haemolysis are restated, as is the question of stimuli towards new formation of blood and the significance of diet for the clinical picture of ankylostomiasis. The question of depletion of iron reserves has, then, no mention. *C. L.*

CRUZ (Walter Oswaldo). Therapeutica da ankylostomose. [**Treatment of Ankylostomiasis.**]—Reprinted from *O Hospital.* Rio de Janeiro. 1933. June. pp. 471–476. With 4 figs.

The essential treatment of ankylostomiasis is iron.

It is held that all modern works on tropical medicine and the writings of most specialists concern themselves only with anthelmintics in the treatment of hookworm infection, though it is in fact a disordered iron metabolism. When iron enters the stomach in whatever form, it is ionized by the gastric juice and transformed into a ferrous salt which is immediately absorbed when it reaches that part of the duodenum where the reaction is still acid. The iron is then carried to the normoblasts in the bone marrow and there stimulates their activity. An advised dose is 3 gm. daily of reduced iron, and it has produced in 20 cases uniform regenerative changes in the red cell series of the bone marrow. The marrow is red in colour and the normoblast is held to contain in ankylostomiasis as much iron as does a normal one, but yet more iron, apparently twice as much, is needed to convert it into a red corpuscle. Deaths from this infection have occurred in Cruz's experience either from toxicity of anthelmintics, or from heart failure due to transfusion of blood, or from the failure to give iron. On giving iron there occurs a latent period of 2 or 3 days before its effects begin to appear in the peripheral blood, and during that period the serious case is in grave danger. No vermifuge should be given till the haemoglobin reaches 50 or 60 per cent. A table shows 12 cases in which after 15 days of reduced iron treatment the mean haemoglobin had risen from 32 to 48

by Sahli's instrument and the red corpuscles from 1,820,000 to 3,310,000, and reproduction of photos show how considerably the oedema had been reduced in one case in that period. *C. L.*

Cruz (W. O.). [In Portuguese & English.] Patogenia da anemia na ancilostomose. Portadores de parasitos. Relação entre a atividade do helminto e a deficiencia de ferro na genese da doença. **Pathogenesis of Anaemia in Hookworm Disease. Parasite Carriers. Relationship between the Activity of the Helminth and Iron Deficiency in the Genesis of the Disease.**—*Mem. Inst. Oswaldo Cruz.* 1934. July. Vol. 28. No. 3. In Portuguese pp. 391–439. With 8 figs. on 2 plates. [32 refs.] In English pp. 440–486.

Although, reputedly, the sole cause of the anaemia of hookworm disease is the hookworm, it is really of little importance in effecting this condition, for the primary factor is alimentary deficiency, a diet defective in iron.

The first of the 3 sections into which the paper falls cites from the literature conclusions of various writers, first that a distinction must be drawn between sick and carriers [the reviewer's suggestion is that no such conclusion can be drawn from the evidence], and second that the difference between the two classes depends on the food they eat. This rôle which nutrition plays is further elaborated, by quotations, in the second section, iron in food being again the point of first importance, in opposition to the view that " in fact, the most modern ideas on this helminthiasis still continue to turn around the two classical doctrines—the toxic and haemorrhagic theories." The third section deals with the pathogenesis of this anaemia. It consists essentially of the records of 5 cases followed for periods varying from over 5 to over 12 months while they maintained worm loads which as measured by eggs varied from 25,000 to 40,000 per gram of faeces.

Case 1 aged 11, with the " common diet " of rice, macaroni, potatoes and milk and 3 gm. of reduced iron daily, improved over 5 months in red cells from 1·34* per cmm. to 4·82 and haemoglobin 13 to 81 per cent. Case 2 on the same diet with ammoniacal ferrous sulphate in varying dosage of 1, 0·2, 0·05 and 1 gm. improved similarly from 2·52 to 4·70 and from 20 to 74 over 9½ months. Case 3 treated as Case 2 but with 0·8 gm. of the drug improved from 1·51 to 5·15 and from 16 to 82. Case 4 treated as was Case 2 improved from 2·53 to 4·46 and from 23 to 76. Case 5 on the common diet and 0·6 gm. of ammoniacal ferrous sulphate improved from 3·40 to 4·85 and from 30 to 88 in 5½ months and then rather more than maintained his position first with 0·3 gm. of the drug for 4 months and then with 2 underdone beefsteaks and 2 eggs daily in addition to his staple diet.

" In our cases, after normalization of blood, the most varying examinations were made, giving results approaching normal or even normal. In these patients the pathogenic action of ankylostoma and the subjective ill-feeling had entirely disappeared ; the patients presented the best disposition to work and, in case of children, to play, just as occurs in infestations by inoffensive intestinal macroparasites.

" In this way we succeeded in producing experimentally carriers of ankylostoma, and thus in elucidating the preponderant rôle of food in the genesis of anaemia."

" We did not try to modify, with diet rich in iron, the blood image in initial ankylostomiasis. The negative result of such an experiment is

*Millions throughout.

clearly understood, as the iron quantity contained in these diets is, by no means, able to exert its influence upon blood, In our opinion, in ankylostomiasis the organism is in a state of martial deficiency, *i.e.*, of very diminished or even exhausted iron reserves. The quantity of these reserves is of a proportional value incomparably greater than the iron contained in food : hence the necessity of massive iron administration and not of milligrams contained even in the richest diets. The contrary is observed after the recovery of the reserve ; then, the necessary doses of iron progressively diminish and even a diet rich in iron prevents the disparity of the metabolic equilibrium." *C. L.*

i. Rhoads (C. P.), Castle (W. B.), Payne (G. C.) & Lawson (H. A.). **Hookworm Anemia : Etiology and Treatment with Especial Reference to Iron.**—*Amer. Jl. Hyg.* 1934. Sept. Vol. 20. No. 2. pp. 291–306. With 5 figs. [39 refs.]

ii. ——, ——, —— & ——. **Observations on the Etiology and Treatment of Anemia associated with Hookworm Infection in Puerto Rico.**—*Medicine.* 1934. Sept. Vol. 13. No. 3. pp. 317–375. With 6 figs. [65 refs.]

i. Blood loss, dietary deficiency and gastronintestinal changes are apparently the causes of hookworm anaemia, and iron produces rapid improvement whether worms have been removed or not.

ii. It is held to be of practical importance that treatment should be directed first against the anaemia of hookworm disease and only secondarily against the parasites, that treatment should be by iron in large doses, and that such treatment will also be advantageous in the economical prevention of the anaemia.

The work on which both papers are based was done in 1931 under the auspices of the Rockefeller Foundation on 83 cases in hospital selected for severity of anaemia, the absence of complicating infections or source of blood loss, and the presence of hookworm ova as assured by " direct examination of the stools," which presumably means by faecal smear. The average haemoglobin by a single Sahli instrument was 32, maximum 59, minimum 8 ; the average red cells 2,820,000, maximum 4,580,000, minimum 780,000. In some of the cases egg counts were made by the Stoll-Hausheer method, in some worm counts by Dr. Florence King Payne from stools obtained after " efficient anthelmintics." Presumably the drug was hexylresorcinol since it alone, used by Lamson's method, is mentioned. [The reference is to the paper in this *Bulletin*, Vol. 29, p. 56, and as there noted this method left nearly half the patients still infected. There is no mention of any faecal examination after treatment ; if this was undertaken by the technique mentioned it could not distinguish dewormed from infected, so that the haematological comparisons of persons before and after treatment cannot be taken as comparisons of the blood state while they were infected and after they had been freed of worms. Indeed, in a field campaign by Nuñez, which it is noted will be reported by her in full, three or more treatments by carbon tetrachloride and oil of chenopodium in unstated doses left a few of 32 patients with a few ova still constantly present. There was not then control of single helminthological factors.]

Biopsies of the sternal marrow were made in 15 patients and will be discussed in a later publication ; the tissue was more cellular than normal, the predominant cell was the normoblast, there were islands of young cells held to be not far removed from the haemopoietic vascular

endothelium and a few held to be of the pluripotential type. The erythroblastic cells were 3 to 5 times as numerous as those of the granulocyte series, instead of both being present in about equal numbers.

As to the blood, " with the exception of the mean corpuscular volume determinations of these patients," who showed an average of 65 compared with Wintrobe's normal of 87, " nothing new is added to the blood picture of the hypochromic anaemia of hookworm disease . . . usually microcytic without evidence of active blood regeneration." The well-known fact is confirmed that there is no relationship between the degree of anaemia and the weight of infection. As regards the possibility that a toxin produced by the worms causes the anaemia, it is pointed out that the removal of the parasites should in that case increase blood regeneration, and that their presence should at least interfere with the action of blood-forming agents. In twelve cases treated with hexylresorcinol the subsequent general gain in red cells was trifling, in two of them these actually were reduced in numbers, and in two others the haemoglobin decreased; in fact the same state of affairs showed itself as in cases watched without removal of worms.

In the absence of evidence for deworming it cannot be admitted that the authors have worked under the conditions necessary for proving their first point; but their work does show strikingly first that improvement of diet obtained by adding to the normal food of these islanders 300 gm. of meat and 1,500 cc. milk did not improve the anaemia of 8 very anaemic and still infected patients who were given no anthelmintic; and second that the administration of 6 gm. of iron and ammonium citrate did so with reticulocytosis, so that the haemoglobin was raised during the varying periods of observation to between 47 (after 18 days) and 70 per cent. (28 days). In a case in which the gastric juice contained no acid on stimulation by alcohol or histamine there occurred within 18 days of beginning iron a rise of red cells from 1,500,000 to 3,400,000 and of haemoglobin from 20 to 40.

A chart illustrates the striking difference between the good effect of removal of parasites in malaria [in which iron from the destroyed parasites is stored in the body] and the negligible effect of so treating hookworm infection [in which it is passed into the lumen of the gut]. Under the heading " The effects of blood loss " it is remarked that injection of washed red cells seems to have a haemopoietic effect as evidenced by a gain of nearly two million red cells and 9 per cent. haemoglobin in one case and a reticulocytosis of 12·6 per cent. in the other, the worms being left in both. As to dietary, it is concluded that the basal diet of these persons contains in peas and beans a reasonably good source of iron, and failure to use it is attributed to lessening of assimilative power.

As to treatment, it is said that Ashford, King and Igaravidez held in their well known report on *Uncinariasis in Porto Rico* that " elimination of hookworms would bring about rapid relief of anaemia in the majority of cases " and that they " did not consider therapy with iron of any particular importance." These writers actually wrote as follows :—" The object of treatment is of course to remove the cause by expulsion of the worms. In many light and moderate cases this will suffice, but in old and chronic cases, and those where the disease has reached a severe grade, some regenerative treatment should follow the specific," and again, referring to tabulated results, " It will be noted that slight cases readily recover without iron." The present

authors were, as stated, deliberately dealing with severe or very severe cases. Gastric anacidity was present in 24 per cent. of 54 cases, but, apparently irrespective of this, the effects of iron and ammonium citrate in daily doses of 6 gm. were good. This drug produced as a rule, but not always, a considerable improvement in the blood even when the worms were left. Of the liver preparations, satisfaction was obtained from an aqueous extract only. Improved diet was without notable effect.

This preparation of iron is suggested as a cheap preventive of the anaemia either with or without an anthelmintic. "It is to be hoped that since the symptomatology of hookworm infection is predominantly that of anaemia, the primary importance and simplicity of dealing directly with the anaemia will be appreciated by those engaged in the problem." [That is to say, when considering prophylaxis the hygienist should primarily treat a symptom and relegate to a subordinate place the getting rid of the grave source of infection for others, which in rural tropical districts is constituted by the faeces of the hookworm infected.] *C. L.*

Sfameni (Mario). Ricerche sulla diffusione dell'anchilostomiasi in limitate zone della provincia di Messina. [**Ankylostomiasis in a District of the Province of Messina.**]—*Riforma Med.* 1934. Oct. 27. Vol. 50. No. 43. pp. 1650–1652.

In a part of the Province of Messina, comprising Scala, Casino, S. Biaggio and Pirrera, the author, who is Health Officer of Torregrotta (Messina), found a considerable number of persons infested with hookworm, some presenting no symptoms of disease. In Scala he found ova in the faeces of 77 out of 292 persons examined; in Casino the same number in 201 examined; all were of the peasant class. [The technique used is not mentioned.] *H. H. S.*

Schwartz (Benjamin) & Alicata (Joseph E.). **Development of the Human Hookworm,** *Necator americanus,* **in Guinea Pigs.**—*Amer. Jl. Hyg.* 1934. Sept. Vol. 20. No. 2. pp. 317–328. With 2 figs.

N. americanus followed in the guineapig its normal development up to the 16th day.

Infection took place both by mouth and skin, and in both cases larvae took the pulmonary circuit. In the lungs they produced the usual haemorrhages and showed signs of an approaching moult. After the 9th day all had left the lungs for the intestine in which they were not found at 24 days, though at 16 they showed the provisional mouth capsule with beginning sex differentiation. *C. L.*

Foster (A. O.) & Cross (S. X.). **The Direct Development of Hookworms after Oral Infection.**—*Amer. Jl. Trop. Med.* 1934. Nov. Vol. 14. No. 6. pp. 565–573. [22 refs.]

For intra-corporeal development of the larvae of *Ancylostoma caninum* the lung journey is unnecessary, and when they are given orally to the optimum host they usually develop directly in the intestine without a pulmonary migration.

Of 8 dogs two were kept as controls; in the others 6 oesophageal fistulae were made, the upper end of the oesophagus being brought out

on one side of the neck the lower end on the other, the latter being firmly bandaged with a pad saturated with a concentrated suspension of santonin and calomel which it was felt would act as a larvicide. Three of the fistulated dogs were infected orally* (2, 5 and 0 days after the operation) as was one control. The other 3 fistulated dogs were infected by skin (1, 0 and 0 days after the operation) as was the other control. As to the orally infected, from the control 39·84 per cent. of the larvae were recovered as worms from the intestine when it died on the 10th day, and from the others 37·02 per cent. when killed on the 26th day and 47·43 after death on the ninth day, while from the third which died on the 3rd day 330 of 2,800 larvae were recovered from the intestine and none from the lungs. As to the skin infected, 7·65 per cent. of the larvae applied were accounted for as worms in the control dog, and in the others 0·14 per cent. and 0 per cent. in dogs killed on the 26th and 15th days; and in one which died on the third day 224 of 2,800 larvae were found in the lungs and none in the intestine.

These results show that the lung journey is not necessary for development to maturity of *A. caninum*, they " give added support to the earlier work of Looss and Fülleborn which indicated that the normal path of migration of nematode larvae was by way of the trachea and oesophagus " and they suggest that the heavier infections which occurred after oral administration may be partly attributable to an escape by the larvae of such hazards as are asssociated with migration. It is held that the extensive studies which have been made by observers show that orally administered larvae of *A. caninum* and perhaps of *Uncinaria stenocephala* migrate from the alimentary canal in non-optimum but not in optimum hosts, so that in the case of other nematodes one cannot without direct evidence assume a pulmonary journey.

C. L.

Yokogawa (S.). **Experimental Studies on the Question why the Mature Larvae of Ancylostoma when ingested by an Improper Host migrate in the Body, and do not migrate when given to the Proper Host.**— *Taiwan Igakkai Zasshi* (*Jl. Med. Assoc. Formosa*). 1934. Sept. Vol. 33. No. 9 (354). [In Japanese pp. 1254–1258. With 4 figs. on 1 plate. English summary pp. 122–125.]

The conclusions appear to be based on blood agar plates and on experiments on 5 animals, using infective larvae of *Ancylostoma caninum*.

" From these experiments with rabbits and dogs we learn that the penetration of mature larvae of Ancylostoma into the wall of the stomach is influenced very much by the physical conditions inside the latter; however, this penetration is not controlled exclusively by physical conditions, but seems to depend much more on the biological nature of the host, because in an improper host, the rabbit, in spite of the presence of water in the stomach, a majority of the larvae entered the wall of the stomach, while on the other hand in their proper host, the dog, the larvae found it difficult to penetrate into the wall of the stomach even under modified conditions that must be expected to stimulate their thigmotropism toward the wall of the stomach." *C. L.*

* The terms used consistently in the paper are " orally " or " *per os*." Presumably infection was produced in the same way as feeding was effected, namely by stomach tube passed down the distal oesophageal opening.

Timpano (P.). La velocità di sedimentazione dei globuli rossi, la resistenza globulare e il tempo di coagulazione del sangue degli anchilostomiasici. [**Velocity of Red-Cell Sedimentation, Red-Cell Resistance and Coagulation Time in Ankylostome Infection.**]—*Ann. d'Igiene.* 1934. Sept. Vol. 44. No. 9. pp. 806–812. [19 refs.]

The cases examined number 30, the controls 5, but the paper does not state the diagnostic method used so that the freedom from infection of the controls is a matter of conjecture.

The finding is that the velocity of sedimentation is increased, the resistance of the red cells lessened and the time of coagulation lessened as compared with anaemics which are held to be uninfected. The changes do not suffice for diagnosis ; their implications on prognosis it is proposed to investigate. *C. L.*

Faust (Ernest Carroll), Wells (Joseph W.), Adams (Corine) & Beach (Ted D.). **Experimental Studies on Human and Primate Species of Strongyloides. III. The Fecundity of Strongyloides Females of the Parasitic Generation.**—*Arch. Pathology.* 1934. Nov. Vol. 18. No. 5. pp. 605–625. With 3 figs.

The paper of which that abstracted in this *Bulletin,* Vol. 31, p. 800, forms a preliminary note (as was conjectured).

The search for adult worms at autopsy was made by washing away and examining the gastric and intestinal contents and scraping off of the mucosa and submucosa of oesophagus, stomach and intestines ; the adult worms were counted. Moreover, as was not gathered from the preliminary note, the trachea and bronchi were similarly treated, and the lungs chopped and strained. Great care was thus taken in the attempt to obtain all worms. It cannot always have been successful since in one of the 17 dogs 600, 800, 150 and 300 larvae were found in 5 gm. portions of faeces during the last 4 days of its life, but when killed all of the 608 female worms found were non-fecund and encapsulated. Similarly in another dog passing in like manner 3, 481, 770, 785 and 2,479 larvae, only a few eggs were found in a small proportion of the 708 female worms disclosed, most of them appearing to be post-productive. The authors' summary is as follows :—

" On the basis of an intensive experimental study of human Strongyloides in young dogs and of a chimpanzee strain of the organism in a rhesus monkey, concrete evidence has been obtained, indicating that following the period of incubation the parasitic female worms produce eggs, the number of which rapidly increases and then gradually decreases to zero. This phenomenon is due not to the escape of the worms from the mucosa of the upper levels of the small bowel, but to reactions in the tissues of the host, including first encapsulation of the egg-laying females and later cellular infiltration around, and phagocytosis of, the worms. Ordinary fecal examination for larvae of Strongyloides has been found a very unsatisfactory criterion of the presence or numbers of parasitic females, in view of the frequent disintegration of larvae en transit down the bowel and because of the gradual reduction in the egg production of the mother worms. Although fecal examinations may consistently fail to disclose the organism for a period of weeks or months, a considerable number of female worms may still be present in the duodenal and jejunal mucosa and be responsible for chronic toxic manifestations. Internal infection (hyperinfection) is offered as an explanation for prolonged human strongyloidosis."

C. L.

Spink (Wesley W.). **Effects of Vaccines and Bacterial and Parasitic Infections on Eosinophilia in Trichinous Animals.**—*Arch. Intern. Med.* 1934. Nov. Vol. 54. No. 5. pp. 805–817. With 5 charts. [16 refs.]

These studies were undertaken to decide the question whether in trichiniasis secondary infections may reduce the number of eosinophils to such an extent as to make the diagnosis uncertain. Guineapigs were used.

" 1. The number of circulating eosinophil leukocytes in animals infected with *Trichinella spiralis* was reduced following infection with *B. tuberculosis, Staph. aureus* and *Trypanosoma equiperdum*. Animals which had received repeated injections of typhoid vaccine responded with a rise in the eosinophil level. No change was noted following the injection of heat-killed tubercle bacilli.

" 2. Studies of the bone marrows from the same animals did not reveal a corresponding decrease in the number of eosinophil cells.

" 3. Trichinous animals having a superimposed infection of tuberculosis or trypanosomiasis had less reaction around the encysted parasites in the muscle than the control animals. Trichinous animals inoculated with typhoid vaccine showed similar changes in the muscles.

" 4. Trichinous animals subjected to a high level of dry heat responded with an absolute rise in the circulating eosinophilic leukocytes.

" 5. No relationship was found between the weights of animals and the level of eosinophilic leukocytes in the peripheral blood.

" 6. The number of circulating eosinophil cells did not appear to be related to the mode of encystment of *Trichinella spiralis* in the muscle."

C. L.

Bachman (G. W.), Molina (R. Rodríguez) & Gonzalez (José Oliver). **Anomalous and Non-Specific Reactions with *Trichinella spiralis* Antigen in Relation to Other Disease Conditions.**—*Amer. Jl. Hyg.* 1934. Sept. Vol. 20. No. 2. pp. 415–423.

A titre of 1 in 2,500 and above in terms of dry weight of powder can, according to the experience of the authors, be termed specific for trichiniasis in 90 per cent. of cases.

" Of the 857 sera studied . . . the titers varied from 1 : 100 to 1 : 3,000. In the precipitation test of the various groups, 18·06 per cent. gave a titer of 1 : 100 ; 19·4 per cent., 1 : 200 ; 41·6 per cent., 1 : 500 ; 11·9 per cent., 1 : 1,000 ; 4·0 per cent., 1 : 1,500 ; 2·8 per cent., 1 : 2,000 ; 2·08 per cent., 1 : 3,000.

" We may deduce from these investigations that the precipitation test for the diagnosis of human trichiniasis does possess a fairly high specificity in relation to other disease conditions. It is the experience of the authors that the presence of the anomalous reactions can be easily differentiated from the true, positive precipitation rings. According to the results of the authors, non-specific precipitation reactions occur in low dilutions at the interphase of the serum and test-antigen, and give rings similar to a true precipitation ring in Wassermann and Kahn reactions and parasitic infestations as well as in conditions where there is nitrogen-retention and increased cholesterol and chlorides in the blood." *C. L.*

Bachman (G. W.) & Oliver (J.). **Virulence of *Trichinella spiralis* in a Natural and in an Experimental Host.**—*Proc. Soc. Experim. Biol. & Med.* 1934. Oct. Vol. 32. No. 1. p. 96.

On successive passages through abnormal hosts trichinella seems to lose in virulence and infectivity.

Repeated rat to rat feedings of trichinous flesh, obtained by killing infected rats at 20-day intervals, given in sub-lethal quantities produced increased infections as measured by the number of larvae in each gram of flesh. Repeated rabbit to rabbit feedings resulted in the dying out of the infection after 5 passages. *C. L.*

Niño (Flavio L.). Consideraciones clínicas y parasitológicas acerca de una observación de triquinosis humana. [**Observations on a Case of Human Trichinosis.**]—*Semana Méd.* 1934. Aug. 16. Vol. 41. No. 33 (2118). pp. 461–488. With 47 figs., 4 plates & 1 graph. [38 refs.]

A very detailed account of a man, 63 years of age, an Italian in the Argentine, who suffered from a subacute suppurative myositis of the left infrascapular region. Operative measures revealed the condition to be due to numerous Trichinella cysts. The pathology is described very minutely and the text is illustrated by no less than 66 figures, mostly micro-photographs. The author is of opinion that many cases are missed, being diagnosed as suffering from influenza, or rheumatic pains. In 1916, at a Hygiene and Pathology Conference, it was reported that 4 per thousand of the pigs examined in the slaughter houses of Liniers were trichinosed, and ten years later this proportion was doubled in spite of the measures of inspection and prevention. *H. H. S.*

Eilmann (H.). Verkalkte Trichinellen in Bärenfleisch. [**Calcified Trichina in Bear's Flesh.**]—*Deut. Tierärzt. Woch.* 1934. Vol. 42. No. 39. pp. 633–635. With 9 figs.

Although not too appropriately placed in a Bulletin catering for tropical readers it may be recorded for completeness that trichinosis is reported in a polar bear. *C. L.*

Graham (G. L.). **Resistance Studies with the Nematode,** *Nippostrongylus muris,* **in Laboratory Rats.**—*Amer. Jl. Hyg.* 1934. Sept. Vol. 20. No. 2. pp. 352–372. With 2 figs. [12 refs.]

A study of helminth "resistance."

"The development of an acquired resistance by rats against reinfection with the nematode parasite, *Nippostrongylus muris*, has been confirmed. It has been shown that the degree of acquired resistance developed is associated with the size of the initial infection, *i.e.*, the heavier the primary worm burden the greater the resistance developed. Repeated exposure to increasingly large numbers of larvae at weekly intervals has been shown to result in the development of a marked resistance as judged by egg count. The resistance was shown to be initiated by comparatively light infections.

"The evidence from the present experiments indicated that 'physiological crowding' of a degree like that observed with *H. spumosa* in rats and *A. lineata* in chickens was not present. However, this does not preclude the possibility that a demonstration of this host-parasite phenomenon can be achieved by suitable methods." *C. L.*

Sweet (W. C.) & Dirckze (H. A.). **A Filariasis Survey of the Southern Province of Ceylon.**—*Ceylon Jl. Sci.* (Sect. D. Med. Sci.) 1934. Dec. 8. Vol. 3. Pt. 3. pp. 177–182. With 1 map.

The authors give the following account of their survey :—

"A rapid filariasis survey of the Southern Province of Ceylon was made between November 16, 1925, and January 15, 1926, by the staff attached to the Anchylostomiasis Campaign. During the survey night blood specimens were taken from 3,371 persons, of whom 163,

or 4·8±0·3 per cent., were found to have microfilariae in their blood. Forty-two cases of elephantiasis were seen by or reported to the staff. Since eleven of the cases of elephantiasis also showed microfilariae in their blood specimens, the total filariasis rate for the Province was 5·8±0·3. The microfilaria rate of males was not significantly different from that of the females examined. . . . All the infections were patchy in distribution. The filaria concerned was assumed to be *W. bancrofti*. No study of mosquito vectors of the disease was attempted." *C. L.*

Hu (Stephen M. K.). **An Examination of Prisoners at Paoshan, Kiangsu Province, for Microfilariae of** *Wuchereria bancrofti* **Cobbold.**—*Chinese Med. Jl.* 1934. Nov. Vol. 48. No. 11. pp. 1143–1145.

The results of examination of thick blood films taken between 9 p.m. and midnight from 146 prisoners are set out.

Of 140 males 24 showed microfilariae and of 6 females 3 did so. Of the 27 positive cases 17 were natives of the Paoshan district and 26 of the Kiangsu province. *C. L.*

Voss (J. A.). Et tilfelle av filariose. [**Case of Filariasis.**]—*Norsk Mag. f. Laegevidenskapen.* 1935. Jan. Vol. 96. No. 1. pp. 17–21. With 1 fig. French summary (4 lines).

Voss describes from Norway a case of filariasis contracted in Tahiti and stresses the importance of bearing in mind tropical disease when treating patients in temperate climates. *C. L.*

Rodenwaldt (Ernst). *Filaria malayi* im Delta des Serajoe. II. [*Filaria malayi* **in the Serajoe Delta [Java].**]—*Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1934. Vol. 23. No. 1. pp. 21–43. With 2 figs. & 6 plates.

In spite of an inadequate and somewhat misleading title, this paper is purely entomological, and is concerned with presumptive mosquito vectors, rather than with *Filaria malayi* itself.

As is now well known, Taeniorhynchus (Mansonia) larvae have the remarkable habit of obtaining oxygen from the roots of water plants, to which they attach themselves by their siphons. Four attempts, with close examination of water plants, to find Taeniorhynchus larvae in the Serajoe delta proved fruitless, despite the fact that species of the genus, especially *M. annulifera*, were present and attacked the local inhabitants throughout the year. Laboratory experiments in Batavia, using 234 living adult Taeniorhynchus (chiefly *M. annulifera*), swamp water and water plants, especially *Pistia stratiotes*—all obtained in the Serajoe delta—were more successful. The author gives a detailed and well illustrated description of the egg and first and second stage larvae of *M. annulifera*, which, like *M. indiana*, deposits its eggs in rafts attached to the under (submerged) side of the edges of *Pistia* leaves. One raft consisted of 129 eggs. The egg and young larva of *M. indiana* are also described. Laboratory conditions proved unfavourable, and no larva pupated ; but the investigation is being continued.

Possible vectors of *Filaria malayi* are briefly discussed. Of mosquitoes caught on human beings, the only species found infected were : *M. annulifera* (73·6 per cent. out of 91 individuals), *M. uniformis* (8 out of 12), *M. indiana* (5 out of 7) and *Anopheles hyrcanus* (16 out of 18).

[For I of this series see this *Bulletin*, Vol. 30, p. 697.]

E. E. Austen.

RODENWALDT (Ernst). *Filaria malayi* im delta des Serajoe. III. [*F. malayi* **in the Serajoe Delta.**]—*Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1934. Vol. 23. No. 4. pp. 194–212. With 17 figs. on 7 plates.

The intermediate hosts and antigen reactions of *Filaria malayi* are considered.

The first section considers the structure of *Mansonia annulifera* and *M. indiana* in their different stages, the second the distribution of mosquitoes during a year at two spots in the Serajoe delta. The third section deals with the local manufacture of dried dirofilaria antigen, dissolved in fifty times its quantity of a mixed salt solution as used by MCCOY, MILLER and FRIEDLANDER and diluted to as much as 1 in 5,000 to 1 in 10,000. Good immediate reactions were obtained equally in 5 cases of elephantiasis without microfilariae, in 5 cases with *Mf. bancrofti* in the blood, and in two natives of the country from a locality where this infection was unknown and who were used as controls. In view of the unspecific character of the reactions which were obtained, the possible use of the adult *F. malayi* when it has been isolated is mentioned, and the difficulties involved in discovering it are pointed out. *C. L.*

RAY (P. N.). **Filarial Affections of the Male Genital Tracts.**—*Indian Med. Gaz.* 1934. Oct. Vol. 69. No. 10. pp. 554–558. With 8 figs. on 1 plate. [13 refs.]

The note draws attention to some recent advances in knowledge of filarial affections of the male genitalia.

These are considered under the following headings. Lymphatic varicocele should not be excised for fear of cellulitis or chylous fistula ; sodium morrhuate injection produced thrombosis in one case. Endemic funiculitis is due to a secondary bacterial infection and half to three-quarters of sufferers die. Hydrocele needs mention only. Chronic epididymo-orchitis is being dealt with in connexion with a case now in the press. Under elephantiasis of scrotum and penis Ray finds confirmation of the reviewer's suggestion, that infective larvae reach the site by the blood escalator, in the consideration of the fact that this condition is very rare in children and that before puberty the blood supply to the parts is little developed. Lymph scrotum is described. In inflammatory reactions the author has failed to obtain evidence of secondary infection. *C. L.*

GRACE (Arthur W.). **Filarial Lymphangitis, considered as a Mild Erysipelas resulting from Hypersensitiveness to a B. Haemolytic Streptococcus of a Particular Type.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1934. Nov. 27. Vol. 28. No. 3. pp. 259–276. With 2 charts. [21 refs.]

The author now feels that the hypothesis of streptococcal latency [this *Bulletin*, Vol. 29, p. 73] is a less satisfactory explanation of recurrent filarial lymphangitis than one based on a tuberculin-like allergy of the affected tissue resulting from numerous minor infections of that tissue.

The argument runs thus. First, evidence that a bacterium is the exciting agent. Clinically the attack resembles that of the mild erysipelas of New York in which, too, a history of previous attacks is

common. Of 110 lymphangitis cases 64·5 per cent. developed abscesses and in all but one the organism was the β-haemolytic streptococcus. Subcutaneous nodules covered by red brawny skin occur in a tenth of lymphangitis cases and in a tenth of them [*i.e.*, presumably in 1 per cent. of the nodules] the same streptococcus is found in pure culture.

A case is described with two nodules, one in the left forearm which subsided, and one in the right leg which suppurated, and the author adds, " It is difficult to believe that the nodule which subsided was due to *Wuchereria bancrofti* and that that which suppurated was the result of pyogenic infection " [could not one become secondarily infected and the other not ?]. The conception of O'Connor's " focal spots " (in which worms have been demonstrated on excision) is that the parasites have nothing to do with their causation, for the worms are so many, it is held, that when a spot is excised it is pretty sure to have one in it, and this will be dead because it has been killed by bacterial toxin. Blood counts during lymphangitic attacks are identical with those of erysipelas, a leucocytosis with polymorphonuclear increase, yet in convalescence there is often an eosinophilia. As to 40 blood cultures in 35 patients 6 were positive in 4 patients. McKinley found none positive in 24. Grace holds it apposite to note that on adding the two together the positive rate is under 7 per cent., much in keeping with the result of blood culture in erysipelas. The morbid histology as described by O'Connor for acute filarial lymphangitis and MacCallum for erysipelas is held to be suggestive of both being erysipelas, though plasma cells, large mononuclears and eosinophils are specifically mentioned in one case and not in the other.

In spite of the stress laid on the similarity of filarial lymphangitis to erysipelas of temperate climates, evidence is offered which is held suggestive that the β-haemolytic streptococcus associated with filarial lymphangitis differs from that commonly met with in temperate climates and is an organism of low virulence. Comparisons of British Guiana with Jamaica, and of the black with Chinese or European populations of Georgetown, British Guiana, leads to the conclusion that the incidence of lymphangitis and elephantiasis among communities is independent of their microfilarial rates, but is correlated with their standard of living and their use of footwear.

The conclusion that the condition is a manifestation of hypersensitiveness to this haemolytic streptococcus is based on reactions to non-haemolytic streptococci, on the fact that it is rarely associated with any organism other than the β-haemolytic streptococcus, that the age incidence of positive Dick tests favours it ; so do the presence of the subcutaneous nodules already mentioned, its high incidence in the lower limbs, the low incidence of positive blood cultures, and the mildness of constitutional symptoms. In fact there is held to be no evidence that *W. bancrofti* plays any part in the production of these lymphangitic attacks. *C. L.*

De (M. N.) & Chatterjee (K. D.). **Streptococcal Septicaemia and Filarial Orchitis.**—*Indian Med. Gaz.* 1934. Oct. Vol. 69. No. 10. pp. 558–560. With 3 figs. on 1 plate.

A discussion of 3 cases among 75 consecutive autopsies leads to the conclusion that the rôle of filarial infection in the causation of fulminant streptococcal septicaemia, though very definite, is not yet fully understood.

The organism found locally or in the blood in all was *Streptococcus haemolyticus*. If it produces little pus formation prognosis is serious. In none of the cases could any source be found for an exogenous infection. It is held as an established fact that in males filarial infection usually remains localized in the genitalia, in which place the streptococcal lesion occurs and the association is explained as possibly due to an upset symbiosis or to some condition of "soil" produced by the worms which is suitable for the streptococcus. *C. L.*

Menon (T. Bhaskara) & Annamalai (D. R.). **Some Pathological Changes met with in Filarial Orchitis and their Significance.**—*Jl. Trop. Med. & Hyg.* 1935. Jan. 15. Vol. 38. No. 2. pp. 18–21. [13 refs.]

Examination of 5 cases leads to the conclusion that the ordinary changes in filarial orchitis are those of foreign-body reaction, and that they are quite different when a microbic infection is added.

The type of inflammatory reaction round worms shows in the tissues clusters of lymphoid cells, eosinophils and mononuclears with a few plasma cells and very few polymorphs, and with large giant cells about the periphery. These last appear to arise partly by fusion of the endothelial histocytes which border the worm node. Local endolymphangitis obliterans with dilatation and hypertrophy of the muscular coat was present. In one case three female worms, alive at operation, were present and all showed the same stage of pregnancy, extreme distension with embryos, so being, it is noted, in agreement with the reviewer's view, that parturition is simultaneously timed. In the other case the females when present were solitary [the hour of operation is not noted in any case]. In the fifth case there were large clusters of polymorphs showing the degenerate nuclei of secondary bacterial invasion. *C. L.*

Homans (John) & (by invitation) Cecil K. Drinker & Madeleine Field. **Elephantiasis and the Clinical Implications of its Experimental Reproduction in Animals.**—*Ann. of Surgery.* 1934. Oct. Vol. 100. No. 4. (Part 502). pp. 812–829. (Discussion pp. 829–832). With 11 figs. [25 refs.]

The paper studies the composition and movement of tissue fluid in experimental and clinical elephantiasis, the condition of the lymphatics therein, and the clinical and surgical implications of the conditions disclosed.

There has been no success in establishing elephantiasis in animals by repeated removal of lymph glands, nor is there positive support for suggestions that the condition is due to disorder of chemistry and water balance in the tissues or to malformation or varicosity of lymphatics. A case is described where pelvic exploration showed scarring of lymphatics over the left pelvic brim, but to be successful in treating the condition operation would have to be early before the lymph vessels in the limb have been obliterated by elephantiasis. That they are so has been proved in experimental filariasis in the dog (*cf.* this *Bulletin*, Vol. 31, p. 806). Thus in the normal dog, when a suitable dye is injected between the toes, light massage causes rapid filling of the whole lymphatic tree, and the lymph vessels can, by the skilled, readily be cannulated. In the dog made elephantoid experimentally, no vessels

are visible, but the dyed lymph can, if the creature is white-skinned, be seen drifting about up or down the limb according to the animal's position, the movement being solely due to gravity. Exactly the same condition has been demonstrated in elephantiasis in man, the sclerosing process has destroyed all vessels and the dye as seen in the skin drifts about in the lymph-soaked tissues according to the position of the limb ; using thorotrast and X-rays the same effect is demonstrated. Some skin areas have, however, remained uncoloured in these conditions, evidently because there the lymphatics are efficient ; so that if something in the nature of an Auchincloss operation is attempted, there is no object in removing skin higher than the point at which lymph, as shown by such a test, is carried off with reasonable efficiency ; and any operation designed to empty the lymphatics of the lower limb into the retroperitoneal sac cannot expect success unless performed before the lymphatic vessels have been destroyed by increasing elephantiasis. Both lymph and tissue fluid in this condition have from 2·7 to 5 per cent. of protein, instead of the normal 1 per cent., and haemolytic streptococci can be cultivated from the tissue fluid of the elephantoid dog in the early hours of each lymphangitic attack but at no other time *C. L.*

FERNANDO (S. E.). **Ocular Filariasis. (Adult *Wuchereria bancrofti* in the Anterior Chamber of Human Eye.)**—*Jl. Trop. Med. & Hyg.* 1934. Jan. 15. Vol. 38. No. 2. pp. 17–18.

The symptoms caused by a worm in the anterior chamber of the left eye and the description of the creature itself are given.

Turbid aqueous humour obscured the fundus of the red, painful and photophobic left eye, but in the anterior chamber was visible a whitish, threadlike worm in ceaseless coiling movement. It was removed through a corneal incision with complete recovery of the eye. Its full published description is as follows :—

" ' The nematode submitted for identification is *Wuchereria bancrofti*, a member of the subfamily Filarinae (order Filaroidea).

" ' Its full length cannot be ascertained as the posterior region is missing. Its present length is less than 90 mm. The females of *Wuchereria bancrofti* reach a length of 100 mm., so that it is possible that the present specimen might have been a full-sized female.

" ' A description of the worm in its present condition is as follows :— It is very delicate, and tapering anteriorly. There is a distinctly enlarged, rounded head followed by a neck. The head bears two rows of papillae. The mouth is terminal and is not surrounded by lips. Oesophagus is long, showing indications of division into two parts. Female genital aperture is slightly posterior to the middle of the oesophagus.' "

The man, a Singhalese, did not come from an endemic filarial area, nor were there microfilariae in the night blood. *C. L.*

i. LOW (G. Carmichael) & MANSON-BAHR (P. H.)., with a Laboratory Report by A. H. WALTERS. **Further Observations on Filarial Periodicity.**—*Lancet.* 1934. Sept. 8. pp. 531–535. With 2 figs.

ii. LANE (Clayton). **The Periodicity of *Microfilaria bancrofti*.**—*Ibid.* Dec. 29. pp. 1437–1441. [11 refs.]

i. The authors have studied another patient suffering from filariasis [see this *Bulletin*, Vol. 30, p. 703] with a view to testing the periodicity

of the appearance of embryos of *W. bancrofti* in the peripheral circulation. The subject was a lascar in whose blood at night these embryos were present in large numbers. Two series of observations were made. In the first, for 4 consecutive days 2-hourly counts were made of the embryos present in 20 cmm. of blood. On the first two days the maximum appeared in the 2 a.m. count, on the last two at midnight. This is explained by the patient falling asleep earlier on these days " thus giving an impetus to an earlier influx of embryos." The total numbers found were fairly approximate with an average of 417 in the 24 hours.

In the second experiment, counts were similarly made at first for 4 days and later for 8 days with the patient reversing his usual habits and turning day into night. [In the text the counts were said to be made 2-hourly in the former period and 4-hourly in the latter, but the graph shows a 2-hourly count throughout, in spite of the statement which occurs more than once that he slept for 4 consecutive hours.]

In the second experiment no irregularity was noticed on the first day ; on the second there was a less rapid fall between midnight and 6 a.m., and a more marked irregularity on the third day. On the fourth the peak was reached at 4 a.m. and the noon figure was 26 compared with the midnight 47 ; this the authors describe as " a marked fall in the total number of embryos at midnight . . . counterbalanced by a marked increase of total numbers at midday." On the 5th to 8th days, the midnight numbers were 40, 59, 53, and 55, the peak being reached at 2 a.m. except on the last day when it was at 4 a.m., and the noon counts were 23, 67, 37, and 48. Only once, therefore, on the 6th day was the noon count higher than that at midnight. The average for the whole 24 hours was higher than under the normal conditions, namely, 448 for the complete period, and 463 for the last 4 days in place of 417. The minimal counts in the last period occurred from 6–8 p.m. The authors infer that it is likely that the same number of embryos are passed into the blood stream every 24 hours, regardless of the habits of the patient and that there is daily migration and reappearance of the same undamaged embryos.

A fortnight after the patient resumed his ordinary mode of living the normal nocturnal periodicity returned. They conclude that periodicity is in some manner dependent upon the habits of the human host and that " irregular periodicity " is a better term [some would regard this as a self-contradictory term]. Thirdly, that the minimal number of embryos in the circulation, whether in reversed or normal life, occurs at about 6 p.m. This is shown to be truer in the reversed than the normal graph in this article.

The authors also carried out an experiment with a guineapig the bearing of which on the argument the reviewer is unable to appreciate. They injected blood containing some 23,000 live embryos into the heart of a guineapig which was killed 5 minutes later and on examination no embryos could be found in the heart blood or organs. Clearly in this case they did not hide in an internal organ and no opportunity was given for them to reappear. It would appear to favour the argument that they were all killed off. [The authors explain this by saying that " the moment they (the embryos) are transferred to incompatible blood they perish." The fact that " none were found " is taken as " none were present." This is, perhaps, hardly justifiable as it would surely be without parallel in pathological experience. From the authors' point of view, however, this absence is, it seems, implied.]

On the *mechanism* of filarial periodicity the authors offer no fresh evidence. They describe the classic cases of MANSON, when the patient died suddenly after a dose of prussic acid and that of an infected Barbadian who died at 10 a.m. and embryos were found in the lungs only. The authors take for granted that the embryos in the first case must have been immediately immobilized " owing to the large dose of the prussic acid taken " and in the second they [so it appears to the reviewer] rather beg the question by assuming that lymph flow ceases immediately on death. Their considered opinion is thus stated in conclusion :—

" We . . . believe that filarial periodicity is best explained by parturition going on more or less continuously, the young being, as Manson put it, nearly constantly carried along the lymphatics and thoracic duct to the blood, while the excess that would in time take place is checked and kept more or less constant by a mortality amongst the older and effete embryos."

[This would equally well, perhaps better, account for absence of periodicity.]

ii. Col. Clayton Lane begins by quoting the final paragraph of the above paper and then passes on to consider the views expressed.

He holds that Drs. LOW and MANSON-BAHR are not justified in assuming that because approximately the same total of embryos is found in certain samples of blood, whether the patient lives normally or reverses his habits, there is daily migration and reappearance of the same undamaged embryos as against the author's (Clayton Lane's) view of regular death of embryos and fresh parturition by the adult females. He mentions that the number of ova in the faeces of a patient with hookworm infestation may be roughly the same day by day although there is no analogous possibility of migration and reappearance.

Another point on which stress is laid is that the normal midnight swarm of embryos occurring at Calcutta (whence the patient came) was found to be the same at Greenwich ; *i.e.*, the periodicity had changed with the change in local time and latitude—why then should change of habits be regarded as a circumstance to alter periodicity ?

As regards the guineapig experiment Clayton Lane notes the work of MURGATROYD who injected the embryos from man to man and remarked on the same rapid disappearance [in this case, of course, the organs could not be examined, so the remark as to the pathological uniqueness of the result may still hold good]. This certainly disposes of the theory of the cause being [species] incompatibility of blood.

FÜLLEBORN'S experiments are related and commented upon. These went to show that the numbers of embryos in different parts of the circulation were not the same in life (or just before death) as shortly after death.

The author then gives an account of some *ad hoc* experiments by Professor C. K. DRINKER and Dr. Madeleine FIELD of Harvard University showing that lymph flow may continue for more than 1½ hours after sudden death from potassium cyanide poisoning. Accordingly the finding of lymph-borne microfilariae in the right heart and lungs after death from cyanide is no proof that they were there at the time of death.

To the statement " why embryos should be able to hold their own against the currents of blood in the heart and large vessels is not clear, but it is a fact that they do " as LOW and MANSON-BAHR have written, and that they may do this by virtue of a spicule and surrounding

papillae, Clayton Lane replies that more modern technique shows that there is no spicule and that they thereby maintain their position is consequently not a "fact."

The analogy with *Dirofilaria immitis* to which Low and Manson-Bahr refer as regards their capability of withstanding the force of the blood-current is not valid, for here it is the adults which wind round the columnae carneae and so maintain their position in the rush of the circulation, and not embryos as in the case of *W. bancrofti*.

Five years ago Clayton Lane concluded that the periodicity must be due to simultaneous parturition of the adult female filariae and O'Connor's findings that in the same cases (and he examined a number) all the female worms were at the same stage of pregnancy at the time of death of the subject and that the cycle is such that under "normal" conditions parturition occurs about midday support this view. [Many readers will call to mind the Meeting of the Royal Society of Tropical Medicine and Hygiene at the end of 1933 when slides were shown of females filled with embryos at noon, but with collapsed and emptied uteri in the cases of those removed two hours later.]

The author from a study of O'Connor's slides and of what is known of the subject concludes that there occur "in this periodic filariasis two parallel cycles each of 24 hours' duration (the first a cycle of intra-uterine development ending with parturition normally about midday, the second the well-known one of the swarming of microfilariae in the blood with its apex about midnight) and that it is merely unreason which after independent confirmation will refuse to connect them as cause and effect." The question of the *site* of the "daily destruction of embryos which must accompany a periodicity due to timed parturition" is one which may more fittingly be taken up after simultaneous parturition has been confirmed. *H. H. S.*

Hinman (E. Harold), Faust (Ernest Carroll) & DeBakey (Michael E.). **Filarial Periodicity in the Dog Heartworm,** *Dirofilaria immitis*, **after Blood Transfusion.**—*Proc. Soc. Experim. Biol. & Med.* 1934. June. Vol. 31. No. 9. pp. 1043–1046.

"It is apparent that, in the case of the dog heartworm infection, periodicity cannot be explained on the basis of cyclical parturition and daily destruction of larvae."

The worm considered is *Dirofilaria immitis*. Recent work on periodicity is considered. The experiment consisted in importing, apparently to New Orleans from Chicago (well outside the endemic area) a dog weighing 12 lbs. which was then kept in a double screened cage. On 29th March a third of its blood was removed and the same quantity of blood from a heavily infected donor injected, the donor being compensated by injection of the citrated blood of the recipient. Before the exchange the donor's blood showed a maximum of 47,000 microfilariae* at 3 a.m. and a minimum of 16,000 at 7 a.m., and after it a maximum of 19,875 at 5 p.m. and a minimum of 6,000 at 7 p.m. The numbers at 5 p.m., which had been 21,400 before the exchange, rose from 6,875 on the 31st March to 44,500 on the 4th of May. The recipient had no microfilariae before the receipt of blood containing 27,475 of them per cc. of donor's blood. After the bloods had become evenly mixed this should have given about 9,000, but only 8 per cent.

* All numbers per cc.

of this number ever appeared in the peripheral blood, the maximum figure immediately after the injection being 750 at 7 p.m. and the minimum 175 at 3 a.m. Thereafter at 5 p.m. the maximum of 750 was counted on 13th April and the minimum of 50 on the 4th of May. "Daily production and destruction of the microfilariae would have returned the count to normal levels within 24 hours" for injection of sodium citrate, of unstated quantity, was shown to produce no apparent reduction in numbers of microfilariae. "The fact that the majority of embryos disappeared almost immediately after transfusion into the recipient may be due to their filtration by the viscera, particularly the lungs as suggested by Fülleborn." *C. L.*

Tisseuil (J.). Processus de destruction des microfilaires vivantes par l'épiploon chez la sarigue philander. [**Destruction of Microfilariae in an Opossum by the Omentum.**]—*Bull. Soc. Path. Exot.* 1934. Oct. 10. Vol. 27. No. 8. pp. 735–737.

This report from the Institute of Hygiene, Cayenne, French Guiana, describes the condition found in the great omentum of an opossum which had infection with a filaria and a trypanosome.

The creature had when seen a gaping wound in the head, in the exudation from which were found microfilariae and trypanosomes. Neither is described. The omentum was nodular from numerous yellowish granulations mostly very small, but a few large and showing encysted adult filariae. The latter on section displayed a wall containing many pigmented cells, many vacuolated cells and a few giant cells. The early cysts containing microfilariae showed masses of these, entire and moving but not progressing, and were lined by a flattened endothelium, the fluid showing few leucocytes, mostly mononuclear. As to their fate, the cyst wall thickens progressively by appearance of giant cells among large mononuclear and a few polynuclear cells, the cyst cavity lessens progressively in size and microfilariae become progressively fewer and show fragmentation, till there is left a double walled granulation surrounding a central vessel clothed with giant and mononuclear cells. It is suggested that the microfilariae group themselves round blood vessels in the attempt to enter them, some penetrating, the rest being immobilized in the cysts. *C. L.*

Low (G. Carmichael). **The Skin Conditions found in *Loa loa* Infections.**—*Jl. Trop. Med. & Hyg.* 1934. Dec. 1. Vol. 37. No. 23. pp. 359–360.

The skin conditions found in, and the diagnosis of, loa infection is considered.

Calabar swellings, a term first used by Thompstone of Southern Nigeria, were believed by Manson to be due to parturition by the female worm because he found microfilariae in fluid obtained by puncturing such a swelling. His patient, however, had embryos in the blood. Low's control, in which a swelling was punctured in one who had no microfilariae in the blood, showed no embryos in the swelling. Low believes the swellings to be due to liberation of toxins from a dead worm. The other skin manifestations dealt with are pruritus, explicable by the presence of the parasite just under the true skin, and giant urticaria perhaps due to some personal idiosyncrasy. Diagnosis of loa infection is by seeing or extracting the worm, seeing embryos in the peripheral blood, the presence of Calabar swellings, unexplained eosinophilia, and Fairley's skin test. *C. L.*

Bamundaga (D.). **An Unusual Case of Dracontiasis.**—*East African Med. Jl.* 1934. Dec. Vol. 11. No. 9. pp. 292–293.

The opening was over the lower angle of the left scapula, and the worm extended over the left clavicle. There were, it is held, two worms described as fused together for the first two inches. ***C. L.***

Brumpt (E.), Duvoir (M. E.) & Sainton (J.). Un cas de cénurose humaine dû au *Coenurus serialis* parasite habituel des lapins et des lièvres.—*Ann. Parasit. Humaine et Comparée.* 1934. Sept. 1. Vol. 12. No. 5. pp. 371–383. With 8 figs. [15 refs.] [See this *Bulletin*, Vol. 31, p. 787.]

Castellani (Aldo). Elephantiasis nostras. (Non-Filarial Elephantiasis.)—*Jl. Trop. Med. & Hyg.* 1934. Sept. 1. Vol. 37. No. 17. pp. 257–264. With 4 text figs., 1 chart & 30 figs. on plates. [See this *Bulletin*, *ante*, p. 73.]

Cawston (F. G.). Neostam in the Treatment of Bilharzia Disease.—*Jl. Trop. Med. & Hyg.* 1934. Oct. 15. Vol. 37. No. 20. pp. 316–317.

Cawston (F. Gordon). The Treatment of Bilharzia Diseases by Antimonium Potassium Tartrate, with the Consideration of Claims advanced for Other Remedies.—*Jl. Trop. Med. & Hyg.* 1934. Dec. 15. Vol. 37. No. 24. pp. 385–386.

Chen (H. T.). Reactions of *Ctenocephalides felis* to *Dipylidium caninum*.—*Ztschr. f. Parasitenk.* 1934. July 21. Vol. 6. No. 5. pp. 603–637. With 2 diagrams & 29 figs. on 4 plates. [3 pages of refs.]

Gallardo (Vicente P.). Anthelmintics in General Practice.—*Jl. Philippine Islands Med. Assoc.* 1934. Sept. Vol. 14. No. 9. pp. 350–353.

Girges (Rameses). The Clinical Aspect of Ascariasis.—*Jl. Trop. Med. & Hyg.* 1934. Dec. 15. Vol. 37. No. 24. pp. 387–392.

Hautefeuille (J.). Méningite vermineuse.—*Ann. Parasit. Humaine et Comparée.* 1935. Jan. 1. Vol. 13. No. 1. pp. 21–27. With 1 chart. [12 refs.]

Leathers (W. S.) & Keller (A. E.). An Analysis of the Hookworm Problem in Mississippi.—*New Orleans Med. & Surg. Jl.* 1935. Jan. Vol. 87. No. 7. pp. 425–433. With 3 maps & 3 graphs. [14 refs.] [See this *Bulletin*, Vol. 31, p. 795.]

Lopez-Neira (Carlos). Terapeutica de las helmintiasis intestinales.—*Medicina Países Cálidos.* Madrid. 1934. Oct., Nov. & Dec. Vol. 7. Nos. 10, 11 & 12. pp. 470–485; 497–528; 545–586. [8 pages of refs.]

Marchal (G.), Soulié (P.) & Grigaut (A.). Néphrose lipoidique et helminthiase. —*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1934. Dec. 24. 3rd Ser. 50th Year. No. 34. pp. 1721–1726.

Montel (Lucien). Etude statistique sur le parasitisme intestinal basée sur 7,000 examens coprologiques.—*Marseille-Méd.* 1934. May 5. Vol. 71. No. 13. pp. 582–597. With 1 chart. [30 refs.]

Tosonotti (Tito). Sopra un caso di cosidetta "appendicite verminosa."—*Policlinico.* Sez. Prat. 1934. Nov. 5. Vol. 41. No. 44. pp. 1726–1732.

YELLOW FEVER.

i. James (S. P.). Renseignements concernant la fièvre jaune reçus pendant les six mois se terminant au 30 septembre 1934. [**Information concerning Yellow Fever received during the Six Months ending 30th September, 1934.**]—*Bull. Office Internat. d'Hyg. Publique.* 1934. Dec. Vol. 26. No. 12. pp. 2096–2102. With 1 map.

ii. Pridie (E. D.). Résultats des récentes recherches sur la fièvre jaune au Soudan Anglo-Egyptien. [**Recent Investigations on Y. F. in the Anglo-Egyptian Sudan.**]—*Ibid.* pp. 2103–2105.

iii. Boyé. Cas probables de fièvre jaune à Port Gentil (Gabon). [**Probable Cases of Y. F. at Port Gentil (Gabon).**]—*Ibid.* pp. 2106–2107.

iv. Jorge (Ricardo). La fièvre jaune africaine. [**African Yellow Fever.**] —*Ibid.* pp. 2108–2122. [11 refs.]

v. Mouchet (R.), van Hoof (L.), Duren (A.), Fornara (L.), Clarebout (G.), Henry (E.) & Henrard (C.). Enquête sur l'endémicité amarile au Congo Belge en 1932–1933. [**Endemicity of Y. F. in the Belgian Congo during 1932–1933.**]—*Ibid.* pp. 2123–2135. With 1 folding map.

vi. Boyé. Application en Afrique Occidentale Française du procédé de vaccination de Laigret contre la fièvre jaune. [**The Application of Laigret's Method of Vaccination against Y. F. in French West Africa.**] —*Ibid.* pp. 2136–2139.

vii. Pierce (C. C.). Epidémiologie et données scientifiques nouvelles concernant la fièvre jaune. [**Epidemiology and New Scientific Information concerning Y. F.**]—*Ibid.* pp. 2140–2141.

viii. Bulletin de l'Office International d'Hygiène Publique. 1934. Dec. Vol. 26. No. 12. pp. 2142–2145.—Rapport de la commission de la fièvre jaune. [**Report of the Y. F. Commission.**]

i. The author deals chiefly with protection tests and vaccination. He briefly summarizes the results of protection tests in various parts of Africa, and also in Brazil, and directs attention to their great importance from an epidemiological point of view. It is evident that there is still much to be learnt about this aspect of the disease and four recent observations are mentioned in this connexion :—the occurrence of outbreaks of yellow fever in rural districts in the absence of *Aëdes aegypti* ; the persistence of the infection for long periods without any obvious cases of the disease, in rural districts, after its disappearance from the large centres of population ; the fact that hedgehogs are susceptible to the ordinary viscerotropic form of yellow fever ; the problem whether or not the virus can persist in the internal organs after its disappearance from the blood, and the degree of fixity of the neurotropic strain of the virus.

Mention is made of the results obtained by Findlay in the serum-vaccination of 75 persons, using horse immune serum prepared by Pettit and Stefanopoulo in Paris. Eighteen of the patients received 0·3 to 0·4 cc. per kilo body weight and the others 0·2 cc. per kilo, in addition to the usual dose of virus. Of these 14 had reactions attributable to the virus and 38 or 50 per cent., suffered from serum reactions due to the foreign protein. From a study on 305 persons vaccinated in various ways, it is found that about 5 per cent. are abnormally susceptible to the virus. In order to avoid any serious reactions, Findlay recommends the injection of a considerable excess of antibodies and by using doses of 0·4 cc. per kilo of the horse immune serum has successfully vaccinated 35 persons without producing any reaction attributable to the virus. Unfortunately, there is the danger

of producing allergic reaction, and there were two cases of serum sickness among these 35 subjects.

ii. The author discusses the results of protection tests in the Anglo-Egyptian Sudan and shows that the distribution of positive sera agrees with the hypothesis that yellow fever came from the west. In the southern part of the Bahr-El-Ghazal, however, there is no evidence of its existence in recent times, whilst in the north, at Wau for example, the infection existed very recently. This absence in the south is attributed to the severe restrictions on any movements of population owing to the existence of sleeping sickness.

The first case of yellow fever in the Sudan to be diagnosed pathologically has been found at Wau, where the liver of a man who died in July, 1934, showed the characteristic lesions. The clinical history of the case agreed with this diagnosis.

iii. Evidence is produced in support of the view that in May, 1934, a small centre of yellow fever existed at Port Gentil. A French couple both became ill ten days after their arrival and the husband died, both cases being diagnosed as alimentary intoxication. An examination of the blood of the widow showed that it contained protective antibodies against yellow fever. It is of interest that the results of protection tests in Port Gentil seemed to indicate that the disease had been absent for at least 12 years, as 19 sera of children aged 7 to 12 were all negative.

iv. An interesting discussion of the yellow fever problem with special reference to the possibility of its spreading to fresh localities. It is aptly pointed out that the disease has fallen from its importance as a world menace for since the discovery of the method of transmission every recent epidemic has been suppressed. With regard to the actual number of cases diagnosed as yellow fever, in 1933 there were only 52 in Africa and 14 in Brazil ; and in the first nine months of 1934, 23 in Africa and 10 in Brazil. Consequently the author is of the opinion that the disease is on the decline, almost on the verge of extinction, and there is no foundation for the pessimistic views that are sometimes advanced as to its dangers.

v. A detailed account of the results of mouse protection tests in the Belgian Congo, from which it would seem that although the endemicity is wider than was realized, conditions do not favour the development of yellow fever epidemics. Nevertheless the presence of a certain degree of endemicity shows that it is necessary to augment the inspection of European centres and also to guard against the increased possibilities in the spread of the disease afforded by modern methods of communication.

vi. An account of LAIGRET's vaccination of 3,196 subjects in French West Africa [see below, p. 285].

vii. A brief summary of various observations on yellow fever, or its vectors, containing nothing new.

viii. The results of mouse protection tests in Africa are summarized as follows :—

In British West Africa out of more than 7,000 sera, 25 per cent. were positive ; in French Niger, 22 per cent. ; in Dahomey, 30 per cent. ; in the Anglo-Egyptian Sudan from 0 to 16 per cent. In the Belgian Congo no positive cases occurred south east of a line from Dilolo to Albertville. In French Equatorial Africa all the territories were found positive. In Angola only a few localities were positive. The Commission reaffirms its confidence in the value of the mouse protection test

and the importance of continuing these investigations. But there is a divergence of opinion as to whether or not the presence of positive sera necessarily indicates the existence of clinical yellow fever. The histological examination of the liver obtained either by the viscerotome or after autopsy is recommended in the cases of all fatal febrile infections of less than 10 days duration occurring in suspected endemic areas.

With reference to vaccination, the Commission urges the importance of following the history of all vaccinated subjects in order to decide the relative value of the two methods at present in use. *E. Hindle.*

BEEUWKES (Henry), MAHAFFY (A. F.), BURKE (A. W.) & PAUL (J. H.). **Yellow Fever Protection Test Surveys in the French Cameroons, French Equatorial Africa, the Belgian Congo, and Angola.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1934. Nov. 27. Vol. 28. No. 3. pp. 233–258. With 4 maps.

Details are given of the results of a yellow fever protection test survey covering the examination of 4,828 specimens in 108 towns of the French Cameroons, French Equatorial Africa, the Belgian Congo, and Angola.

Results of similar studies have been previously published by the Belgian Mission, and also by BOYÉ and JORGE [this *Bulletin*, Vol. 31, pp. 831–832]. Except in French Equatorial Africa the percentages of positive sera were much lower than in West Africa proper, probably owing to the fact that conditions in these regions are relatively unfavourable to the maintenance of yellow fever infection. Although extensive epidemics have occurred both recently and in the past, at present endemicity seems to be excluded throughout this entire region.

In French Equatorial Africa 1,643 specimens were examined and 18·4 per cent. were positive, but no case of yellow fever has ever been reported from the Colony in spite of the fact that the protection tests indicate that extensive epidemics of the disease must have occurred within recent years. High percentages of positive sera were obtained in many towns in the interior including several near the border of the Anglo-Egyptian Sudan. The findings in the coastal area indicate that the incidence during recent years has been almost negligible.

In the French Cameroons only 3·6 per cent. were positive in 496 specimens collected in nine towns. The children were almost completely negative and the specimens from adults showed a fair percentage of positives in only two towns.

The survey in the Belgian Congo included the examination of 1,740 specimens from 43 towns, and 8·8 per cent. of these were positive. The interior seems to have been completely free from yellow fever during recent years, but has experienced the disease in the past. The results in towns along the Congo and Oubangui rivers suggest the possibility of the infection being carried into the interior of French Equatorial Africa by river traffic.

The results of the examination of 949 specimens from Angola showed only 11 positive, and the practically negative findings in the south and south-eastern portions of the Belgian Congo and throughout Angola, indicate that the limits of yellow fever invasion in these directions have been reached.

[The results recorded by JORGE (this *Bulletin*, Vol. 31, p. 832) seemed to indicate that 44 out of 950 sera from Angola were positive.

These figures were derived from the author's table (p. 1402) giving a summary of the results, in which the *percentages* of positive and doubtful sera were totalled, giving the erroneous impression of an incidence four times higher than was actually the case.] *E. H.*

Recio (A.). Absence d'immunisines anti-amariles chez les Cubains nés après la disparition de la fièvre jaune. [**The Absence of Yellow Fever Immune Bodies in Cubans born since the Disappearance of the Disease.**]—*Bull. Acad. Méd.* 1934. Nov. 6. 98th Year. 3rd Ser. Vol. 112. No. 35. pp. 543–546.

By means of the mouse protection test the author has examined specimens of serum collected from 27 white and 14 coloured Cubans. The results are given in tabular form and show that 12 out of 16 persons born previous to 1901 contained antibodies against yellow fever, but the sera of the 25 subjects born subsequent to this date gave uniformly negative results. *E. H.*

Dudley (Sheldon F.). **Can Yellow Fever spread into Asia? An Essay on the Ecology of Mosquito-Borne Disease.**—*Jl. Trop. Med. & Hyg.* 1934. Sept. 15. Vol. 37. No. 18. pp. 273–278. [18 refs.] Also in *Jl. Roy. Nav. Med. Serv.* 1935. Jan. Vol. 21. No. 1. pp. 16–28. [18 refs.]

An interesting speculative essay on the possibilities of yellow fever spreading into Asia.

The author directs attention to the nature of the sea-borne traffic between East Africa and Asiatic ports, which is largely conducted by Arab dhows and coasting sailing vessels, as primitive as ever were the old sailing ships which carried yellow fever across the Atlantic. These sea-lanes should be as easy for the disease to travel by as was ever the old " middle passage " from West Africa to the Caribbean Sea in the past.

A comparison of the geographical distributions of *Aëdes aegypti*, dengue and yellow fever, respectively, suggests that the races of *A. aegypti* east of longitude 20, while remaining good carriers of dengue become inferior vectors of yellow fever [but see below, p. 292]. Although there may be biological differences between the races of *A. aegypti* in various parts of the world, as suggested by certain transmission experiments and supported to some extent by epidemiological evidence, it is aptly pointed out what little things may upset the balance of Nature, and it is conceivable that an increase in the rapidity and amount of mechanical transport might compensate for a hypothetical inferiority of the potential local vector, or even allow the West African races of yellow fever mosquitoes to gain ascendancy over the races to the east of them and extend their range into Asia. It is of the greatest importance, therefore, that sanitary and ships' medical officers should do all in their power to improve, encourage and enforce any measures which will hinder " yellow Jack " in travelling eastward from his stronghold in Central Africa.

This valuable article contains in addition many well-chosen examples of the epidemiology of insect-borne diseases, and should be read in its entirety by those interested in the subject. *E. H.*

Nicolle (Charles). L'infection inapparente, forme naturelle d'extinction de certaines maladies infectieuses. [**Non-Evident Infections, a Natural Stage in the Disappearance of Certain Infectious Diseases.**] —*Arch. Inst. Pasteur de Tunis.* 1934. Dec. Vol. 23. No. 4. pp. 438–440.

The author sees in the results of protection tests for yellow fever in the Anglo-Egyptian Sudan [this *Bulletin*, Vol. 31, p. 833], a demonstration of the existence of a disease which has ceased to produce any clinical signs of its presence, but can still be detected by the protective antibodies that are found in the serum. It is considered that this is a very good example of the final stage in the extinction of an infectious disease, an interesting hypothesis developed by the author in his essay "*Destin des maladies infectieuses*," published by F. Alcan, Paris.

E. H.

Mathis (C.). Pouvoir protecteur exercé vis-à-vis du virus amaril de souris par le sérum du sujet ayant fourni la souche française du virus de la fièvre jaune. [**The Protective Action against Mouse Yellow Fever Virus of the Serum of the Patient who furnished the French Strain of Virus.**]—*Bull. Acad. Méd.* 1934. Oct. 23. 98th Year. 3rd Ser. Vol. 112. No. 33. pp. 338–340.

The French strain of yellow fever virus was originally obtained in 1927 from a mild case of the disease in a young Syrian at Dakar [see this *Bulletin*, Vol. 25, p. 538]. After an interval of about 7 years the author examined the serum of this subject by means of protection tests in mice, and found that it contained antibodies against the mouse virus, though only to a slight degree. *E. H.*

Stefanopoulo (G. J.) & Mollaret (P.). Hémiplégie d'origine cérébrale et névrite optique au cours d'un cas de fièvre jaune. [**Hemiplegia of Cerebral Origin and Optic Neuritis in the Course of a Yellow Fever Case.**]—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1934. Nov. 19. 3rd Ser. Vol. 50. No. 29. pp. 1463–1465.

The possibility of ordinary yellow fever virus showing neurotropic affinities is supported by the authors' account of a patient who developed hemiplegia and other nervous symptoms following an attack of yellow fever. The authors produce convincing evidence in support of the view that the nervous lesions were the result of the yellow fever, and insist on the danger of nervous complications in using neurotropic virus for vaccination. Consequently they advocate the use of combined virus and immune serum for this purpose instead of virus alone.

E. H.

Mathis (C.), Laigret (J.) & Durieux (C.). Trois mille vaccinations contre la fièvre jaune en Afrique Occidentale Française au moyen du virus vivant de souris, atténué par le vieillissement. [**Three Thousand Vaccinations against Yellow Fever in French West Africa, by Means of Living Mouse Virus, attenuated by Age.**]—*C. R. Acad. Sci.* 1934. Oct. 15. Vol. 199. No. 16. pp. 742–744.

The authors have submitted a total of 3,196 Europeans in French West Africa to the method of vaccination involving three inoculations of living mouse virus attenuated by age, in the same way as the spinal cords of rabbits infected with rabies.

The infected mouse brains were attenuated for one, two and four days respectively and then dried *in vacuo*. Appropriate doses of the dried material were made up in ampoules and used for inoculation. The treatment consisted of three inoculations at intervals of 20 days, first of the virus attenuated for 4 days, next of the 2-day virus and finally of that attenuated only one day.

According to the authors no local reaction has ever been observed, but about one-third of the subjects showed a febrile reaction after the first, less frequently after the second, and very exceptionally after the third inoculation. The reaction developed 6 days after the inoculation and was accompanied by fever, headache, and pain in the orbit and back, which lasted from 12 to 30 hours. Two cases presented more severe symptoms, one a meningic syndrome and the other a myelitis with a transitory paraplegia. They both recovered, however, and neither the blood nor the cerebrospinal fluid was infective to monkeys or mice.

Among those vaccinated in Senegal, 70 per cent. acquired immunity after the first inoculation but three inoculations are recommended. Nevertheless, the authors mention that cases of yellow fever [numbers not stated] have occurred in patients at least 20 days after the third inoculation, so the method is not infallible. *E. H.*

Laigret (J.). Résultats d'une mission effectuée en A.O.F. pour l'organisation de la vaccination contre la fièvre jaune. [**The Results of a Mission in French West Africa for the Organization of Vaccination against Yellow Fever.**]—*Bull. Soc. Path. Exot.* 1934. Nov. 14. Vol. 27. No. 9. pp. 813–816.

——. La vaccination contre la fièvre jaune (quatrième mémoire). Sur une mission pour l'application de cette vaccination en A.O.F.—*Arch. Inst. Pasteur de Tunis.* 1934. Dec. Vol. 23. No. 4. pp. 413–437.

The author gives a brief summary of the method of vaccination recommended by him, namely three inoculations of attenuated mouse virus, suspended in glycerine [see this *Bulletin*, Vol. 31, p. 79], and gives the results of applying the method for the protection of more than 3,000 subjects in French West Africa. Since the inoculations seem to have been attended without any accidents, except nervous symptoms in two cases which both recovered, the establishment of a centre in France is advocated, so that persons could be vaccinated under favourable conditions and acquire immunity before arriving in the endemic areas. For the present the Pasteur Institute at Tunis will continue to prepare the vaccine, and will send it to Paris, where the inoculations will be made gratuitously at the Pasteur Hospital by Dr. René Martin. Since yellow fever vaccination by the use of virus and immune serum is also practised at the same hospital, the author asks that any person wishing to have virus alone should demand the " Method of the Pasteur Institute, Tunis." *E. H.*

Findlay (G. M.). **Immunisation against Yellow Fever with Attenuated Neurotropic Virus.**—*Lancet.* 1934. Nov. 3. pp. 983–985. [17 refs.]

The author gives the results of inoculating rhesus monkeys with attenuated virus as used by Mathis, Laigret and Durieux in their mass experiments in West Africa.

Six monkeys were inoculated subcutaneously with 1 cc. of a 1 in 100 dilution of infected mouse brain, attenuated by an exposure of 4 days at 20°C. Four of these monkeys showed virus in the peripheral blood stream and developed immunity; the remaining two remained negative but did not develop any immunity. On receiving the second inoculation of mouse virus, attenuated for 2 days, these two monkeys both showed virus in the blood and subsequently became immune. An additional four monkeys were inoculated with only 0·5 cc. of the 4-day vaccine. Three showed virus in the blood and one of these developed encephalitis after 12 days and virus was found in large quantities in its brain. The fourth monkey showed no virus in its blood and did not develop immunity.

These results support the view that the development of immunity is correlated with the circulation of living neurotropic virus in the peripheral blood stream and emphasize the danger of using this method of vaccination for human immunization. The barrier between the blood stream and the brain may be broken down and the central nervous system invaded by the virus, as seems to have been the case with two of the persons vaccinated by LAIGRET [above]. Moreover it is well known to occur in mice and guineapigs inoculated with the neurotropic virus as well as in monkeys. A further danger is the possibility of the neurotropic virus suddenly reverting to the viscerotropic form, for experiments with hedgehogs [see below, p. 290] show that the mouse virus should be regarded as pantropic rather than strictly neurotropic.

Finally, the presence of active neurotropic yellow fever virus in the blood during the course of vaccination renders the patient a potential danger both to himself and the community if any of the known mosquito carriers of yellow fever are present, for it has been shown that *Aëdes aegypti* is capable of taking up this virus from the blood of monkeys and transmitting it to other animals [see this *Bulletin*, Vol. 30, p. 355]. In view, therefore, of the dangers attending this method, the use of attenuated neurotropic virus for human immunization is not recommended. *E. H.*

FINDLAY (G. M.). Immunisation contre la fièvre jaune au moyen de virus neurotrope vivant et d'immunsérum hétérologue. [**Immunization against Yellow Fever by Means of Living Neurotropic Virus and Heterologous Immune Serum.**]—*Bull. Acad. Méd.* 1935. Jan. 22. 99th Year. 3rd Ser. Vol. 113. No. 3. pp. 78–95. [32 refs.]

A good general discussion of the subject followed by an account of the results obtained in the immunization of 100 persons against yellow fever by means of inoculations of living neurotropic virus and heterologous immune serum prepared by PETTIT and STEFANOPOULO.

It is considered advisable not to use neurotropic virus after more than 150 passages in mice, as after 200 passages the neurotropism has a tendency to become augmented and, moreover, antigenic modifications may possibly develop and interfere with the development of immunity against the original virus.

The author emphasizes the dangers of using living virus attenuated in various ways, since the circulation of virus in the circulation constitutes a source of danger not only to the patient but also to the community in tropical countries where the transmitting agent occurs.

When, however, immune serum in sufficient quantity is injected any reactions due to the virus are checked, and at the same time virus does not circulate in the blood. The necessity for an adequate dose of immune serum is well exemplified in the history of 100 cases, 70 males and 30 females, who were vaccinated in this way. When less than 0·3 cc. per kilo. body weight of immune serum was used 15 out of 57 cases showed reactions which could be attributed to the action of the virus. The remaining 43 cases received injections of 0·3 to 0·4 cc. per kilo body weight and such reactions were suppressed. Approximately half of all the cases treated showed reactions due to the injection of the heterologous proteins. In 3 cases there was definite local oedema two hours after injecting the serum but in all the others the reaction appeared between the 3rd and 10th day. Only 9 subjects are stated to have shown symptoms of any importance. *E. H.*

LAIGRET (J.). **Immunisation against Yellow Fever. Vaccination and Sero-Vaccination.** [Correspondence.]—*Lancet.* 1935. Jan. 19. pp. 176–177.

A reply to the foregoing communications.

The author admits that the multiplication of the virus in the vaccinated organism is the essential condition in the development of immunity, but the intensity of this infection is so feeble that up to the present he has been unable to prove the virulence of the blood in any vaccinated persons. In the case of FINDLAY's monkeys, the relatively large dose inoculated is considered to be the reason why he was able to infect mice with their blood. With regard to the fear that the living vaccine transmitted by mosquitoes from vaccinated to non-vaccinated persons could communicate yellow fever, return to virulence has never occurred under the conditions of human vaccination. Reference is also made to unpublished experiments by the author in conjunction with MATHIS and DURIEUX. Each day for 20 days different batches of mosquitoes were fed on vaccinated persons and subsequently fed on unvaccinated persons and finally ground up and inoculated into rhesus monkeys. None of the men or monkeys showed any signs of any infection nor developed immunity. The risk of a meningeal reaction although real is considered to be very slight, in view of the fact that in more than 3,000 human vaccinations only two cases have been observed, and both recovered without sequelae. *E. H.*

MATHIS (C.) & MATHIS (M.). A propos de la vaccination contre la fièvre jaune. [**Vaccination against Yellow Fever.**]—*Bull. Acad. Méd.* 1934. Dec. 18. 98th Year. 3rd ser. Vol. 112. No. 41 pp. 817–820.

A polemical reply to FINDLAY's article on this subject [above].

The authors maintain that the publications cited do not support his conclusions that the attenuated virus may produce encephalitis in man and also that mosquitoes biting inoculated subjects may possibly become capable of transmitting yellow fever. The various publications, including the present authors' more recent experiments are summarized with the object of showing that there is no satisfactory evidence that neurotropic yellow fever virus can change into the viscerotropic form during a single passage. Moreover, 4,000 vaccinations by means of attenuated neurotropic virus have been practised in French West Africa without producing any signs of the disease. *E. H.*

Duren (A.). Où en est la question de la vaccination contre la fièvre jaune. [**The Present Position of Vaccination against Yellow Fever.**]—*Bruxelles-Méd.* 1935. Jan. 13. Vol. 15. No. 11. pp. 300–303.

A general account of the subject. *E. H.*

Mathis (C.), Durieux (C.) & Advier (M.). La vaccination anti-amarile comporte-t-elle des dangers dans les régions où la fièvre jaune sévit endémiquement et où les "Stegomyia" abondent? (Première note.) [**Is Yellow Fever Vaccination Dangerous in Regions where the Disease is Endemic or where "*Stegomyia*" abounds?**]—*Bull. Acad. Méd.* 1934. Nov. 6. 98th Year. 3rd Ser. Vol. 112. No. 35. pp. 535–538.

Three patients were inoculated each with 1 cc. of a one per cent. suspension of neurotropic virus equivalent to 0·002 gm. of mouse brain, and none of them showed any reaction. The serum of each patient was subsequently tested in mice for its protective properties. The serum of one of them protected 4 out of 5 mice, the other two gave inconclusive results. Mosquitoes (*Aëdes aegypti*) were fed on all three patients during the 6 to 8 days following the inoculation of the virus, and subsequently allowed to bite two *Macacus rhesus*, neither of which developed any signs of infection. One of these monkeys was also inoculated with the ground-up contents of these mosquitoes, also with negative results.

E. H.

Dhont (C. M.), Schüffner (W. A. P.) & Snijders (E. P.). Over het gedrag van het neurotrope "virus fixe" der gele koorts bij caviae en rhesus-apen. [**Action of the Neurotropic "Fixed Virus" of Yellow Fever in Guineapigs and Rhesus Monkeys.**]—*Nederl. Tijdschr. v. Geneesk.* 1934. Oct. 20. Vol. 78. No. 42. pp. 4826–4836. With 5 figs. on 1 plate. [10 refs.] English summary.

The first animal in which successful transmission of yellow fever from man was obtained was the monkey *Macacus rhesus*. That was a great step forward, but the possibilities of experimentation were greatly opened up when it was shown that the guineapig and the mouse were both susceptible animals.

In the present series of experiments the first attempt was to transmit the neurotropic virus, the mouse "fixed virus," to the guineapig. Infective material for the first inoculation in guineapigs was obtained from mice in the 183rd passage of the Dakar strain. One half a mouse brain in unfiltered suspension, diluted 1–500 in 1 per cent. peptone and in dose of 0·01–0·02 cc. per guineapig, was used in intracerebral injection. None of the animals died of shock and none within 24 hours, which contrasted strongly with earlier experiments. This satisfactory result is ascribed to the use of what was now a neurotropic instead of a viscerotropic virus and a smaller dosage. About 4 days after inoculation a definite rise of temperature occurred (average 40·2°C.), then a fall to normal and, before death, a collapse temperature of about 35°. Loss of weight was the other main sign of infection. As in mice, the pathological condition was one of encephalitis, which was shown histologically by the characteristic perivascular lymphocytic "cuffing" of the cerebral vessels. The guineapig brain virus could be identified as a true yellow fever virus by using the protection test with a known yellow fever immune serum and a control normal serum respectively. The virus could

also be transmitted from one guineapig to another in series and again back to the mouse without loss of pathogenicity. An experiment was carried out to show the transmissibility of guineapig virus to the monkey by intramuscular injection. There were no immediate symptoms but the animal fell sick after 20 days with apparent paralytic symptoms and died on the 25th day. Two monkeys were inoculated with blood and liver suspensions respectively intramuscularly from this one. Both sickened 21 days later and both recovered. These two monkeys were subjected to the bite of a group of infective *Aëdes aegypti* mosquitoes (viscerotropic virus), but except for a rise of temperature in one of them to 40·6° were not otherwise affected although a control monkey bitten by the same mosquito died of yellow fever. The deduction made is that the inoculation of blood and of liver suspension respectively gave rise to a slight attack which was recovered from and that this rendered the monkeys immune to yellow fever. The neurotropic yellow fever virus can also be transmitted from mice by intramuscular injection to monkeys. The disease is more protracted than the usual septicaemic one and death may not take place for 3 weeks. A final experiment showed that intramuscular injection of the neurotropic virus in the monkey results probably in a temporary septicaemia which, however, is not demonstrable after the 3rd day. In this respect it contrasts with the viscerotropic virus.

Their results, say the authors, taken as a whole, accord very well with those of the American and French workers and may be regarded as confirmatory. *W. F. Harvey.*

Lloyd (Wray) & Mahaffy (A. F.). **The Use of Guinea Pigs in Tests of Immunity against Yellow Fever with Small Quantities of Serum.** —*Amer. Jl. Trop. Med.* 1935. Jan. Vol. 15. No. 1. pp. 51–58.

The advantage of being able to obtain a neutralization or protection test with such minute amounts of serum as may be obtained from infants led the authors to test the possibility of using guineapigs in the same way as Theiler used mice [see this *Bulletin*, Vol. 28, p. 723].

The results of inoculating serum-virus mixtures intracerebrally into guineapigs are compared with those of protection tests in mice, and in a series comprising 116 sera gave correct results in 95 per cent. of the cases. For the test 0·05 cc. of a 0·5 per cent. neurotropic virus suspension was mixed with 0·15 cc. of the serum to be tested and then incubated at 37°C. for two hours. *E. H.*

Findlay (G. M.) & Clarke (L. P.). **Infection with Neurotropic Yellow Fever Virus following Instillation into the Nares and Conjunctival Sac.**—*Jl. Path. & Bact.* 1935. Jan. Vol. 40. No. 1. pp. 55–64. With 2 charts. [16 refs.]

The nasal instillation of neurotropic yellow fever virus in monkeys and mice was found to be followed by the development of encephalitis.

Virus also reached the peripheral blood stream in small quantities 72 hours after instillation in mice, after which it disappeared. In five out of six rhesus monkeys infected virus was present in the blood 48 hours after instillation but had disappeared by the 6th day. In the sixth monkey the virus appeared in the blood on the 5th day and disappeared on the 7th day.

The virus was present in the olfactory lobes of a monkey and in the cerebral hemispheres of mice 2 days after nasal instillation, and then spread generally throughout the brain. The instillation of virus in the conjunctival sacs of 20 mice was followed by the development of encephalitis in 8 individuals after an average incubation period of 10 days, whilst with nasal instillation 36 out of 50 developed encephalitis after an average period of 9 days. In a discussion of the possible routes by which the infection reaches the brain it is considered that whilst the direct extension of virus along the axones cannot be entirely excluded, there is considerable evidence to show that the perineural sheath spaces are a possible and probable means of spread.

It was found that 5 monkeys containing immune bodies in their blood were immune to nasal instillation of the virus. Twelve mice that had survived nasal instillation were inoculated intracerebrally with the virus and with one exception all developed encephalitis; therefore it would seem that these mice had escaped the previous exposure owing to non-absorption of virus from the mucosa of the naso-pharynx. *E. H.*

Stefanopoulo (G.), Mollaret (P.) & Desnos (E.). Inoculation du virus de la fièvre jaune au Porc. [**The Inoculation of Yellow Fever Virus into the Pig.**]—*Bull. Soc. Path. Exot.* 1934. Nov. 14. Vol. 27. No. 9. pp. 816–820. With 5 figs. on 2 plates & 1 chart.

A young pig was inoculated intracerebrally with a neurotropic strain of yellow fever virus; four days later it showed a sudden rise of temperature and subsequently developed nervous symptoms with progressive paralysis and died on the 7th day, with typical symptoms of myelo-encephalitis. Nevertheless six mice inoculated with the cerebrospinal fluid, and a monkey and six mice inoculated with an emulsion of the brain of this pig remained uninfected, and the monkey subsequently was inoculated with virus and died of yellow fever.

A second pig was inoculated subcutaneously with a viscerotropic strain, then 4 weeks later with a neurotropic mouse strain, and finally with two more doses of the ordinary virus. Protection tests with the pig's serum were feebly positive 28 days after the first inoculation, but became strongly positive after the last two doses. The cerebrospinal fluid was also strongly protective. *E. H.*

Findlay (G. M.) & Clarke (L. P.). **The Susceptibility of the Hedgehog to Yellow Fever. II.—The Neurotropic Virus.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1934. Nov. 27. Vol. 28. No. 3. pp. 335–345. With 8 figs. on 2 plates.

The authors have previously recorded the susceptibility of the hedgehog to viscerotropic strains of yellow fever virus [this *Bulletin*, Vol. 31, p. 841] and in the present article show that this species is also susceptible to neurotropic strains injected intracerebrally, subcutaneously or intraperitoneally.

The symptoms develop in 6 to 11 days and are invariably fatal but, unlike what is found in other susceptible animals, at death virus is present not only in the brain, but also in the liver, kidneys, spleen and adrenals, though only rarely in the blood. Virus obtained from the organs of hedgehogs produces a fatal encephalitis in mice and even after 10 passages in hedgehogs behaved as a fixed neurotropic strain

and moreover did not acquire any increased capacity for producing visceral lesions. It can be passed through Seitz filters and is neutralized by known yellow fever immune sera.

The changes produced by the neurotropic strains in the hedgehog include very slight lesions in the central nervous system, but especially focal degeneration in the liver, with acidophilic necrosis of the cytoplasm, occasional intranuclear inclusions and infiltration with mononuclear and polymorphonuclear leucocytes. In the stomach there are petechial haemorrhages in the gastric mucosa. The characteristics of neurotropic and viscerotropic yellow fever virus in the hedgehog are shown in the table.

Characteristics of Neurotropic and Viscerotropic Yellow Fever Virus in the Hedgehog

	Viscerotropic strain.	Neurotropic strain.
	Incubation period in days.	
	4–7	6–11
	Distribution of virus in tissues at death.	
Blood	+++	±
Brain	++	+++
Liver	+++	++
Spleen	+++	++
Kidney	+++	++
	Lesions.	
Liver	General necrosis	Focal necrosis
Kidney	Extensive degeneration of tubular epithelium	Degeneration of occasional epithelial cells
Stomach	Black vomit and haemorrhages	Occasional small haemorrhages
Heart	Fatty degeneration	No lesions
Brain	No lesions	Slight increase in microglia: occasional perivascular infiltration and increased mononuclear reaction in meninges

E. H.

FINDLAY (G. M.), HEWER (T. F.) & CLARKE (L. P.). **The Susceptibility of Sudanese Hedgehogs to Yellow Fever.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1935. Jan. 25. Vol. 28. No. 4. pp. 413–418. With 4 figs. on 1 plate.

The results of these experiments show that Pruner's hedgehog from the Sudan is susceptible to yellow fever and the possibility of such a species acting as a reservoir for the virus cannot be ignored.

Four Pruner's hedgehogs (*Atelerix albiventris*=*Erinaceus pruneri*) from the Sudan were inoculated subcutaneously with viscerotropic yellow fever virus. The first two were inoculated, one with liver and the other with blood of a monkey infected with the Asibi strain; both died of yellow fever after 4½ and 9 days respectively. The third hedgehog, inoculated with a Berkefeld filtrate of the liver of an infected European hedgehog, died after 22 days and a monkey inoculated with the liver of this animal died of yellow fever 11 days later. This hedgehog had been kept at 50° to 60°F. and was in a semi-comatose condition for 15 days after inoculation. The prolonged duration of the disease in this individual may possibly be due to the

hibernating condition, for a European hedgehog kept at the same temperature also showed an incubation of 17 days when inoculated with yellow fever.

The fourth Sudanese hedgehog inoculated with a Seitz filtrate of the liver of the second one, did not die, although a European hedgehog inoculated with the same material died in 6 days. It was subsequently found to be immune. *E. H.*

Mathis (Maurice). Biologie comparée, en conditions expérimentales, de quatre souches du moustique de la fièvre jaune. [**The Comparative Biology, under Experimental Conditions, of Four Strains of Yellow Fever Mosquitoes.**]—*C. R. Soc. Biol.* 1934. Vol. 117. No. 35. pp. 878–880.

The author compared four strains of *Aëdes aegypti* obtained respectively from Athens, Cuba, Dakar and Java, with regard to the duration of the various stages in their development, and also the number of eggs in the first two batches to be laid.

All four strains resembled each other very closely, the hatching of the eggs being produced by the same microbial factors, the larval stage lasting from 6 to 8 days (at 28°C.), the adults emerging after a nymphal stage of 48 hours, and the females laying their eggs within 48 hours of a blood meal. Unlike *Culex pipiens* and *Anopheles maculipennis* there is no evidence of the existence of distinct races, and the author is of the opinion that *Aëdes aegypti* is a very homogeneous species in all parts of the world and consequently is a potential source of danger for the transmission of yellow fever in all countries where climatic conditions are favourable. *E. H.*

Mollaret (Pierre) & Stefanopoulo (G. J.). Le liquide céphalo-rachidien lombaire et sous-occipital dans la fièvre jaune expérimentale du *Macacus rhesus*. [**Lumbar and Sub-Occipital Cerebrospinal Fluid in Experimental Yellow Fever in** *Macacus rhesus*.]—*C. R. Soc. Biol.* 1934. Vol. 117. No. 37. pp. 1101–1103.

Nine rhesus monkeys were inoculated subcutaneously with a viscerotropic (Asibi) strain of yellow fever and the cerebrospinal fluid was examined in each. In spite of the absence of nervous symptoms, in every case there was a leucocytic reaction in the fluid collected on the 2nd to the 4th day after inoculation, consisting entirely of lymphocytes, which rose in some cases as high as 150 elements, with an average of 30 to 60. The albumen content, Pandy's reaction and precipitation of colloidal benzoin showed no important changes.

In two other monkeys the inoculation was followed by the development of nervous symptoms and in one of these inoculated with a neurotropic strain, and which only showed signs of illness on the 15th day, there were marked changes in the cerebrospinal fluid as indicated in the following table :—

Albumen.	Leucocytes.	Pandy's reaction.	Colloidal benzoin.
Before inoculation 0·15 gm. ...	7·2	—	0000010000000000
15th day after ,, 0·65 gm. ...	50·0	—	0000022220000000
18th ,, ,, ,, 1·00 gm. ...	67·2	+	0000002222100000

Five monkeys inoculated into the nervous system with a neurotropic strain all showed reactions analogous to the preceding case.

A resistant monkey and also six immunized animals all showed a lymphocytic reaction when inoculated with yellow fever virus. In three out of four monkeys inoculated with a neurotropic strain the cerebrospinal fluid contained virus from the 3rd to the 11th day of the disease. Moreover it was positive in 3 out of 9 monkeys inoculated with a viscerotropic strain.

In vaccinated or recovered monkeys the cerebrospinal fluid develops protective antibodies, sometimes to a very high titre, and the results in general support the view that yellow fever virus has certain neurotropic affinities. *E. H.*

Nicolau (S.), Kopciowska (L.) & Mathis (M.). Etude sur les inclusions de la fièvre jaune. [**A Study of Yellow Fever Inclusions.**] —*Ann. Inst. Pasteur.* 1934. Nov. Vol. 53. No. 5. pp. 455–508. With 36 coloured figs. on 1 double plate. [Refs. in footnotes.]

The present study is mainly an expanded account of the results previously published in a series of notes [see this *Bulletin*, Vol. 31, pp. 499, 842 & 843]. The authors' main conclusions, based on the examination of human cases of yellow fever, and also of monkeys, mice, guineapigs and rabbits infected in various ways, are that the real yellow fever inclusions are oxyphilic bodies without any internal structure, sometimes surrounded by a halo, occurring in the karyoplasm, which is somewhat rarified, but still preserves its staining properties.

The dimensions of the bodies vary from less than 1μ in diameter up to 3 or 4μ, and generally they are multiple in each cell. It is necessary to distinguish these bodies from the oxychromatic degeneration of the nucleus of the infected cell, the result of its death or injury. The yellow fever inclusion body is supposed to be a response of the nucleus to the invasion of the virus, each particle of which is supposed to be enclosed in a kind of envelope, with the object of preventing its multiplication. These bodies are found not only in the nervous system but also in other cells derived from the ectoderm, such as hepatic and endothelial cells, also endothelioid cells of the spleen.

The authors consider that the so-called neurotropic strains of yellow fever do not multiply exclusively in the nervous sytem, as the virus can be found in the circulating blood for some days after being injected into the peritoneal cavity. It is thus not strictly neurotropic in the same way as rabies, poliomyelitis or Borna's disease. *E. H.*

Hughes (T. P.). **A Partial Purification of Yellow Fever Virus through Adsorption and Elution.**—*Jl. Bacteriology.* 1934. Oct. Vol. 28. No. 4. pp. 401–413. With 3 charts.

By using the well-known method of adsorption on kaolin followed by selective elution with dilute ammonia the author has made preparations of " mouse " yellow fever virus possessing a high degree of activity and having a protein content at least 50 times less than can be demonstrated by chemical tests for protein.

A suspension of infected mouse brain in distilled water was centrifuged and the supernatant fluid passed through a Seitz filter. To 9 cc. of the resulting filtrate was then added 2·25 cc. of a 40 per cent. suspension of kaolin in distilled water and the mixture shaken for 1 hour at room temperature. The kaolin was then removed from the supernatant fluid and both tested for virus. The virus was found to have been completely adsorbed by the kaolin, from which it was released by the addition of N/10 and N/100 ammonium hydroxide solution, but not by weaker dilutions (N/1,000).

Further experiments using a glycerine-acetate non-toxic buffer system, showed that the virus was adsorbed throughout its range of survival from pH 6·5 to 10·0. One-tenth volume of kaolin was found sufficient to adsorb all virus from suspensions having a low protein content, but was not effective in suspensions containing 50 per cent. serum (about 2·5 per cent. protein). For satisfactory results the protein content should be kept low.

Experiments with varying concentrations of ammonia showed that N/100 NH_4OH was the optimal one for routine use, and two minutes elution was sufficient to release the virus from kaolin. The virus particles evidently behave differently towards kaolin than do serum proteins or other substances present in blood serum or brain extracts. They are more rapidly and completely adsorbed (within 15 minutes) and when so adsorbed are released by a lower concentration of ammonia. The partial purification of yellow fever virus seems to be accomplished with ease and rapidity by means of this method. *E. H.*

Hoskins (Meredith). **An Attempt to transmit Yellow Fever Virus by Dog Fleas** (*Ctenocephalides canis* **Curt**) **and Flies** (*Stomoxys calcitrans* **Linn.**).—*Jl. Parasitology.* 1934. Sept. Vol. 20. No. 5. pp. 299–303.

Dog fleas, *Ctenocephalides canis* Curt., were fed on rhesus monkeys infected with yellow fever and then allowed to bite normal monkeys immediately afterwards and at intervals of 7 to 72 hours. In no case was infection produced by their bites, but by injecting the contents of these fleas into monkeys it was found that the virus survived for 7 hours in the gut but died out before the expiration of 18 hours.

In the case of the stable fly, *Stomoxys calcitrans* Linn., infection was produced by bites 6 hours after the infective blood meal, but not after 16 hours. The contents of these flies remained infective up to 42 hours after the meal but the injections of flies 48 and 72 hours after feeding did not produce yellow fever in normal monkeys. The fact that these flies will readily bite a new host immediately after being interrupted in feeding suggests that they may be potential carriers of some importance. *E. H.*

Journal of the Royal Naval Medical Service. 1935. Jan. Vol. 21. No. 1. pp. 28–34. With 1 fig.—**The Menace of Yellow Fever.** By a Medical Officer, Royal Navy.

A general article on the subject, containing extracts illustrating the dangers of yellow fever in the past, and in particular an interesting

account of the organization of mosquito control service in Rio de Janeiro, which has been applied at all the larger Brazilian ports.

E. H.

GORDON (R. M.). **Notes on Yellow Fever, with Special Reference to the Possibility of its Recurrence in Sierra Leone. With a Foreword by the Director of Medical and Sanitary Services, Sierra Leone.**—1934. Dec. 20 pp. Freetown: Govt. Printer.

A useful summary of the main facts concerning yellow fever with special reference to the possibility of its recurrence in Sierra Leone. The information has been brought up to date and issued in pamphlet form as a book of quick reference for any Medical Officer who may be called upon to contend with an outbreak of the disease. *E. H.*

SNIJDERS (E. P.), POSTMUS (S.) & SCHÜFFNER (W.). On the Protective Power of Yellow Fever Sera and Dengue Sera against Yellow Fever Virus.—*Amer. Jl. Trop. Med.* 1934. Nov. Vol. 14. No. 6. pp. 519–545. [27 refs.] [See this *Bulletin*, Vol. 31, p. 840.]

RELAPSING FEVER AND OTHER SPIROCHAETOSES.

KEMP (Hardy A.), MOURSUND (W. H.) & WRIGHT (Harry E.). **Relapsing Fever in Texas. IV.** *Ornithodorus turicata* **Duges : a Vector of the Disease.**—*Amer. Jl. Trop. Med.* 1934. Sept. Vol. 14. No. 5. pp. 479–487. [10 refs.]

The authors give various notes on *Ornithodorus turicata*, with special reference to the transmission of relapsing fever in Texas.

The tick seems to be widely distributed in Texas, having been recorded from several localities, usually sandy caves, in the north and south central parts of the State. Its rôle in the transmission of the disease has been demonstrated experimentally by the production of infection in rabbits, monkeys and rats, by the bites of these ticks. When feeding the larvae attach themselves very quickly, and become engorged within 10 to 30 minutes, when they detach themselves and leave the host. The nymphs usually behave in the same way, but the adults generally remain attached for hours, even up to two days. Coxal fluid is secreted during the feeding but this fluid does not seem to carry the infection, as no spirochaetes could be found in it, and rats inoculated with the fluid remained uninfected. Moreover, infection was produced by the bites of ticks in which the coxal apertures had been sealed with collodion.

Ticks were killed and examined at intervals of 2 to 15 days after feeding on a rat heavily infected with the Texas spirochaete. The organisms were found to make their way to practically every organ of the body, large numbers being found especially in the connective tissue. Although hereditary infection had been recorded the authors, in three experiments, obtained negative results by the inoculation of rats with saline emulsions of eggs laid by infected ticks. *E. Hindle.*

SACHS (Albert). **Relapsing Fever in Chitral.**—*Jl. Roy. Army Med. Corps.* 1934. Oct. Vol. 63. No. 4. pp. 217–230. With 1 map in text.

The author has analysed the medical case sheets of 50 cases of human relapsing fever that occurred in Chitral during 1932 and 1933, and gives a general account of the disease.

It is caused by a spirochaete morphologically resembling *S. recurrentis*, and the fever in all respects conforms to the known types. It is generally very mild, however, and first attacks may be missed especially as the onset has a close resemblance to that of malaria, for which it has frequently been mistaken. The incubation period varies between 5 and 15 days.

With reference to transmission clinical evidence supports the view that both tick and louse-borne types are present. No cases have occurred during the Chitral reliefs, when large numbers of troops march along the Hindustan-Chitral road, but always camp in the open, and do not use the levy posts or employ coolies. The disease seems generally to be contracted at one of the levy posts along the Dir-Drosh section and as the cases occur mostly in the hot weather the evidence is more in favour of the tick-borne type. *Argas persicus* was found in large

numbers at one post where the disease was prevalent, and in addition examples of *Ixodes reduvius* and *Hyalomma aegyptum*. Bugs were found at all the posts.

No definite evidence as to immunity is available since no strains of spirochaetes are now obtainable in India. *E. H.*

Villain (G.). Septième cas de fièvre récurrente hispano africaine observé en Tunisie. [**Seventh Case of Spanish-African Relapsing Fever observed in Tunis.**]—*Arch. Inst. Pasteur de Tunis.* 1934. Dec. Vol. 23. No. 4. pp. 447–448.

The record of a case of infection, presumably with *Spirochaeta hispanica*, in a native of Tunis, living about 10 miles north of Enfidaville. The course of the disease was typical and spirochaetes were found in the patient's blood, but a monkey and two guineapigs inoculated with blood containing rare spirochaetes on the 9th day of the disease, and also two guineapigs inoculated with lice from the patient, failed to show any signs of infection. *E. H.*

Kleine (F. K.) & Krause (M.). Die Rolle der Wanze bei der Verbreitung des Rückfallfiebers. [**The Rôle of Bugs in the Spread of Relapsing Fever.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1934. Nov. Vol. 38. No. 11. pp. 486–487.

The authors conclude that bed bugs can only play a very small part as a reservoir for relapsing fever, not to be compared with that of ticks or lice. [See Rosenholz, this *Bulletin*, Vol. 24, pp. 685–7.]

Larvae of bed bugs were fed on mice infected with strains of both European and African relapsing fever. From the sixth day onwards 2 to 10 specimens were ground up after various intervals and inoculated into mice. Out of 300 bed bugs 4 per cent. were found to be infective at intervals up to 80 days after the meal of infected blood, but out of 150 adult bugs similarly fed and inoculated into mice after 6 days interval, none produced infection. In addition 3,000 larvae from infected parents were inoculated into mice with negative results.

E. H.

Kroó (H.). Studien ueber Immunität und Chemotherapie bei neugeborenen und erwachsenen Tieren. Untersuchungen ueber die Spirochäteninfektion der Hühner. [**Immunity and Chemotherapy of Newly-Born and Adult Animals. Researches on Fowl Spirochaetosis.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1934. Dec. 31. Vol. 84. No. 1. pp. 1–13.

Adult fowls and one-day old chicks were inoculated intramuscularly with similar doses of fowl spirochaetes. In the adult birds the infection lasted only 3 to 5 days, whilst in the one-day old chicks it was much more prolonged, the birds remaining positive up to 16 days after infection (in one case 21 days).

When killed spirochaetes were inoculated no immunity developed in the one-day old chicks, whilst the adult birds developed a well marked resistance.

In spite of the favourable chemotherapeutic index for arsenobenzol in the treatment of fowl spirochaetosis, one-day old chicks inoculated with the maximum tolerated dose were not cured, for after a time

spirochaetes reappeared in the blood. Unlike the blood of adult fowls similarly treated, the serum of the infected chicks, inoculated with chemotherapeutic agents, had little or no spirochaeticidal property. This is said to be in accordance with the fact that the relapse strain was immunologically identical with the original strain. The prolonged duration of the infection, the failure of chemotherapy to effect a cure, the occurrence of relapses, and the absence of spirochaeticidal antibodies in the serum, are considered to have a common basis. However, one-day chicks after infection and treatment were resistant against reinfection in the same way as adult fowls. The development of spirochaeticidal antibodies and obvious immunity seems to be a process which varies at different periods in the life of the fowl. *E. H.*

Grillo (J.) & Krumeich (R.). Experimentelle Untersuchungen ueber Misch- und Sekundärinfektion. V. Mitteilung : Ueber die Beeinflussung der experimentellen Naganainfektion des Meerschweinchens durch eine Mischinfektion mit der *Spir. usbekistanica* oder dem Spirillum der Rattenbisskrankheit (Sodoku), sowie durch chemische Substanzen, die eine Temperatursteigerung oder sonstige Stoffwechseländerungen bedingen. [**The Influence on Nagana Infection in Guineapigs of a Mixed Infection with either** *S. usbekistanica* **or the** *Spirillum* **of Rat-Bite Fever, also of Chemical Substances causing a Rise in Temperature.**]—*Zent. f. Bakt.* I. Abt. Orig. 1934. Oct. 5. Vol. 132. No. 7/8. pp. 385–403. With 2 figs. [22 refs.]

The authors find that mixed infection with either *S. usbekistanica* or *Spirillum minus* affects the course of the disease in guineapigs infected with *Trypanosoma brucei*, the life of the animals being prolonged and the numbers of trypanosomes appearing in the circulation considerably reduced. In mice, mixed infections did not influence the course of the disease.

When guineapigs infected with *Trypanosoma brucei* were injected with chemical substances that raised the body temperature, such as pyrifer and sulfosin, the length of life of the guineapigs was prolonged, even though the substances had no obvious trypanocidal action. Similar results were also obtained with iodisan and thyroidin, other substances producing alterations in the general metabolism of the guineapigs.

Discussing these results and previous work on the subject the authors consider that in the case of mixed infections the effect of the second infection is to give an additional stimulus to the cells comprising the defence mechanism of the host, with the result that there is an increase in antibody formation against both infections and correspondingly the life of the host is prolonged. *E. H.*

Levaditi (C.), Vaisman (A.) & Païc (M.). Dissociation des fonctions de mobilité et de reproduction chez les spirochètes et les trypanosomes, au moyen du rayonnement total de la lampe à mercure. [**Dissociation of Motility and Reproduction in Spirochaetes and Trypanosomes by Means of the Total Rays of the Mercury Lamp.**]—*C. R. Soc. Biol.* 1934. Vol. 117. No. 30. pp. 357–361. With 1 chart. [13 refs.]

The authors have exposed the Brazzaville strain of *Spirochaeta duttoni*, the fowl spirochaete, and *Trypanosoma evansi*, respectively,

to the total rays from a mercury lamp of 500 watts at a distance of 40 cm. In each case exposure to the radiations for periods of 10 to 30 minutes destroyed the reproductive capacity of the organisms but did not affect their motility. *E. H.*

COLEMAN (George E.). **Relapsing Fever Problem of California.**—*Amer. Jl. Public Health.* 1934. Oct. Vol. 24. No. 10. pp. 1056–1061. [20 refs.]

A general review of the subject, with special reference to the author's own observations. *E. H.*

REVIEWS AND NOTICES.

Strong (Richard P.), Sandground (Jack H.), Bequaert (Joseph C.) & Muñoz Ochoa (Miguel). **Onchocerciasis with Special Reference to the Central American Form of the Disease.**—*Contrib. from Dept. of Trop. Med. & Inst. for Trop. Biol. & Med.* Harvard Univ. No. 6. pp. xiv+234. With 2 maps, 103 figs. & 6 plates. 1934. Cambridge, Mass: Harvard Univ. Press, London: Humphrey Milford, Oxford Univ. Press. [21s.]

This monograph comes from the Department of Tropical Medicine and the Institute for Tropical Biology and Medicine of Harvard University. Each part deals with that section of the subject in which the writer's special knowledge gives him special authority.

In Part II Sandground deals with the validity of the various species of *Onchocerca*. He has obtained an unrivalled collection of material from Strong's first Guatemalan expedition, and has compared it with much from a number of different sources. He considers the generic characters; as to those of species his criterion is this: "In order to establish a new species safely, it is necessary to point out constantly present, and if possible easily recognizable, zoological characters by which it may be distinguished from related forms." He concludes, first that *O. caecutiens* Brumpt, 1919, is a synonym of *O. volvulus* Leuckart, 1893; and further that, on the basis of his material, there must fall within the same species *O. flexuosa* (Wedl, 1856) of *Cervus elephas*, the red deer of Central Europe [which in that case becomes the valid specific name], *O. gibsoni* Cleland and Johnstone, 1910, from Australian cattle, and perhaps the lost *O. lienalis* (Stiles, 1892) if indeed it belongs to this genus. Moreover *O. indica* Sweet, 1915, is a synonym of *O. gibsoni*; *O. cervicalis* Railliet and Henry, 1910, is a synonym of *A. reticulata* Diesing, 1841; and *O. bovis* Piettre, 1912, is one of *O. gutterosa* Neumann, 1910.

In Part III Bequaert deals equally helpfully with the taxonomy of the Simuliidae of Guatemala. Three have been demonstrated to be transmitters of Onchocerca, namely *S. metallicum* Ballardi, 1859 which name takes precedence of *S. avidum* C. C. Hoffman, 1930; *S. callidum* (Dyar and Shannon, 1927) which displaces *S. mooseri* Dampf, 1927; and *S. ochraceum* Walker, 1861. A general survey, based on the literature, is made of the preadult stages of the Simuliidae, and apparatus is described by which the adult is bred from the larva. For this the essential requisite is that the water used shall flow at not less than 1·1 kilometres per hour. The optimum rate is 4·5 and the upper figure is at least 30. It is illusory to slow speed by damming a stream in the hope that breeding will then cease in it, for it will persist at the weirs. As to temperature, breeding is possible from just below the snow line to a hot spring at 30·6°C.

Muñoz Ochoa describes in Part IV the local geography, seasons, climate, population and its customs, and the epidemiological statistics of certain coffee plantations in which at different ages the infection rate varies from 10 to 60 per cent. in males and from 0 to 33 per cent. in females, and notes that newcomers never escape the bites of simulium.

In Part I Strong provides the cement for the narrative. The onchocerca area in Guatemala is a strip on the Southern slope of the central range, some 60 miles long and 20 miles wide by the shaded map, and varying from 2,000 to 4,500 feet in altitude ; and in it the inhabitants of 4 coffee plantations have been examined, for it is in them with their shade trees that the infection is most prevalent. In that one, Moca, in which the housing and sanitation of the permanent staff is the best, there is an infection rate among them of 40 per cent., yet in another, Helvetia, which lies 20 miles outside the present limits of endemicity, and in which close examination has failed to reveal any infection, the geographical and climatic conditions were practically the same as in Moca—that is to say numberless steep valleys with more or less swiftly-flowing streams with simulium breeding abundantly in all of them, and a fertile volcanic soil 8 to 14 feet deep. All seem to have a floating as well as a permanent Indian working population. Accordingly the immunity of Helvetia, that is the absence there of infective simulium flies, remains unexplained, though it is suggested that such flies may be wind-borne, or carried as stowaways in the ears of animals. Unexplained also is the localization of nodules about the head. This can hardly be attributed to the settling down of infective larvae at the spot where the simulium bite occurred, for although as the photographs show these Indians are ordinarily well covered with clothing, yet when working the men may wear nothing but a loin cloth and a large woven palm hat, and simulium bites almost invariably out of doors and by day. Again comparison with the photographs illustrating HISSETTE's work on the Belgian Congo (this *Bulletin*, Vol. 30, p. 709) where, also, blinding onchocerciasis is prevalent, bears this out, for most of the persons there shown have the body largely bare ; the expedition which Strong aims at making to this area should shed welcome light on the problem.

A full review of this monograph is impossible, but it is noteworthy that 11 per cent. of proved infections had no palpable tumours, so bringing the infection into line with that produced by *O. gibsoni* in the horse. Considerable space is suitably given to the ocular lesions, which occurred in 5 per cent. of cases only, and to the siting of microfilariae in the eye. As to removal of tumours, cases are recorded where others have appeared nearby, but in this locality 4 per cent. of simulium flies were infected. On the other hand the removal of all onchocerca tumours in a population of about 1,000 led to a drop in the infection rate from 40 to 4·5 per cent. in one year. Such are some of the important facts displayed in a notable publication. *Clayton Lane.*

CRAIG (Charles F.) [M.D., M.A. (Hon. Yale), F.A.C.P., F.A.C.S., Colonel, U.S. Army, Retd., D.S.M., etc.]. **Amebiasis and Amebic Dysentery.**—pp. viii+315. With 54 figs. 1934. London : Baillière, Tindall & Cox, 7–8 Henrietta Street, Covent Garden, W.C.2. [22s. 6d.]

In this book the author presents his readers with a very good account of the modern conception of amoebiasis of man, which he defines as the invasion of the tissues by the pathogenic amoeba *Entamoeba* (spelt *Endamoeba* according to American custom) *histolytica* (not *dysenteriae* as some American writers would insist). He adopts the view that amoebiasis is not synonymous with amoebic dysentery, which he regards as an unfortunate term for it gives rise, in the minds of most

medical men, to the idea that dysentery is the most common symptom of amoebic infection, whereas in the vast majority of cases the symptoms are so mild that they are often attributed to some other cause. The author believes, however, that the presence of the amoeba in the intestine is definite evidence of intestinal lesions, for he is not one of those who thinks that *E. histolytica* can live harmlessly in the lumen of the intestine like *E. coli*. The carrier, though he shows no evident symptoms of infection and may never have had dysentery, yet definitely has intestinal ulceration, the symptoms of which can usually be detected if carefully looked for.

In connexion with the epidemiology of amoebiasis, the world distribution is discussed, while the methods of spread by food handlers, flies and other means are critically examined. The conclusion is reached that though infection is as a rule necessarily sporadic, there do occur from time to time, particularly when gross faecal contamination of the water supply occurs, veritable epidemics, the most recent and striking of which the author considers to be the Chicago outbreak. This is said to have resulted from direct communications between the pipes of the water supply and sewage system in one or more large hotels. In fact it was this outbreak, resulting in the discovery that amoebiasis is far more widespread in the United States than had been suspected before, that induced the author to write this book for the assistance of medical men who had had little previous experience of the disease.

The description of the causative amoeba *Entamoeba histolytica* and the various non-pathogenic amoebae with which it may be confused, the symptomatology and pathology of intestinal amoebiasis and the complications and sequelae which may follow is carefully done. On the subject of diagnosis it is suggested that an X-ray investigation of the condition of the intestine in symptomless carriers might throw light on the character and extent of the lesions in these cases. As regards the modern method of inspection of the lower part of the large intestine by the sigmoidoscope as an aid to diagnosis the author expresses some scepticism, for he contends that it is always possible to detect the amoeba by faecal examinations if these are properly carried out. Some authorities in this country may be inclined to disagree with the author in this for it seems that often time may be saved by sigmoidoscopy, which has enabled amoebae to be discovered in scrapings from an ulcer when faecal examinations had been consistently negative. On the other hand, it is clear that the instrument can give no information as to the condition of the intestine above the sigmoid flexure.

It is well known that the author has devoted much time to investigations on the complement fixation reaction as a test for amoebiasis, and in this book he has devoted a whole chapter to its consideration. The technique of carrying out the test and the method of preparing the antigen from cultures of *Entamoeba histolytica* are carefully described. Those who are interested in this subject will be grateful to the author for his clear account of the test, which has been elaborated mainly by himself. On the question of treatment the author's views appear to be sound. No extravagant claims are made for any particular line of action and the timely warning is given that there is no method of treatment which will eliminate infection with *Entamoeba histolytica* in every case.

Such are some of the features of this very interesting and useful book. It is well got up and has an adequate supply of illustrations, most of which are microphotographs of what must be very excellent prepara-

tions. Whether microphotographs are as good for instructional purposes as carefully executed drawings is an open question. However, in this case they seem to answer very well the purpose for which they are intended. There can be no doubt that the book is a good one, which can be recommended with confidence to medical men seeking information on the subject with which it deals. *C. M. Wenyon.*

BARRAUD (P. J.) [F.R.E.S., F.Z.S., F.L.S., Entomologist to the Malaria Survey of India, Indian Research Fund Association]. **A Practical Entomological Course for Students of Malariology.**—*Health Bull. No. 18. Malaria Bureau No. 9.* pp. viii+141. With 208 figs. on 18 plates. 1934. Delhi: Manager of Publications. [Rs. 1–10 or 2s. 9d.]

It is interesting to compare the arrangements made for teaching a subject in different parts of the world, and we welcome the present Bulletin which gives detailed information about a course on the entomological side of malariology. We understand that the class has been organized in its present form for about ten years at Karnal in the Punjab under the Malaria Survey of India, and that Captain Barraud has been in charge of the entomological teaching for six years. Teaching in entomology occupies the whole of the students' time for two weeks: the contents of the Bulletin are divided to provide 14 lectures and 14 periods of practical work.

It is evident that teachers in India experience the difficulty which is familiar in this country: the entomological teaching must start at the beginning, and it cannot be assumed that the student has any general knowledge of the structure or nature of insects. After introducing a few elementary fundamental facts, the teacher proceeds to an account of the structure of the adult and larva, certain parts of which are described in great detail. On this basis of anatomical knowledge the students are then taught to identify Indian species of Anopheles in the adult and larval stages. During the course of the fortnight, they also receive instruction in dissection and mounting, in observing the criteria of the age of a mosquito, and on the enemies and parasites of these insects. The class also goes collecting, and is shown how to find larvae and transport them, how to rear Anopheles from the egg, etc. Catching stations are also visited. A consideration of the precipitin test is, very rightly we think, not included in the entomological part of the course. The Bulletin contains a full list of necessary apparatus and of diagrams and relevant literature shown to the class from time to time. It contains also valuable notes on small but important points of method for use in the field or the laboratory.

The reader will discover that the course at Karnal deals very thoroughly with the Indian species of Anopheles and that much emphasis is given to the anatomical side of the subject. Your reviewer feels that some of the anatomy might be omitted. The student must certainly learn enough to understand a description of an Anopheles adult or larva so that he can identify it; but is he concerned with the Chaoborinae, the rotation of the terminalia, the empodium, tentorium, parabasal spines and other "beggarly rudiments"? In the course which is outlined in the Bulletin under review the anatomical lessons are taught very thoroughly, but one wonders whether the student realizes that all the preventive problems with which he has to deal centre round the live insect. If the opportunity ever occurred of

planning so full a course, our own inclination would be to reduce the anatomy to that which is necessary for the recognition of species. We should like to find more time for observing living mosquitoes and experimenting with them; the students might be made to expose larvae which they had identified to different types of water, or they might offer vessels containing different types of water to adult females in a cage. They should also make observations with wet and dry bulb thermometers on the resting places which are chosen or avoided by mosquitoes in nature or in captivity, and perhaps study the length of life of several species under different climatic conditions. Above all things they should give time to the study of the house-haunting habit, enumerating the females of different species found in different parts of a house or a stable (and here they might be introduced to simple statistical tests of significance). A course such as this would be difficult to organize, but it would tend to throw emphasis on the relation of species to malaria. We suggest that the time has come for the malariologist to follow the modern zoologist, discarding much anatomical study and concentrating attention on the living creature.

P. A. Buxton.

Missiroli (Alberto) [Direttore della Stazione Sperimentale per al Lotta Antimalarica]. **Lezioni sulla epidemiologia e profilassi della malaria impartite agli allievi della R. Università durante l'anno scolastico 1933–34.** [Lectures on the Epidemiology and Prevention of Malaria.] Pubblicate a cura di B. Aureli, Bibliotecaria. —552 pp. With 156 figs., 37 graphs & 8 plates (6 coloured). 1934. Rome. Ditta Armani di M. Courrier, Via Cesare Fracassini 60 [Lira 80.]

Professor Missiroli has done good service to students of malariology in collecting into a single volume the course of lectures on the Epidemiology and Prophylaxis of Malaria which he delivered at the University of Rome in 1933–34. The treatment of those parts of the subject of malariology with which he purports to deal is very thorough; the question of treatment is outside its scope and is not touched upon, except in so far as it enters into prophylaxis. We find no mention of blackwater fever, which is a pity for Professor Missiroli would probably be able to throw valuable light on the present obscurities of this condition; at least we would look for an admirable summarization of the present position of the problem.

The subject is dealt with in the following order :—a chapter on the history and distribution of malaria, first a general review and then a more detailed account of its prevalence in Italy in ancient and in modern times. A graph shows the fall in mortality from 1887 to 1930 and two maps indicate by the depths of shading the reduction in malaria and malarial cachexia in the triennia 1887–89 and 1928–30. The next chapter describes the epidemic types of the disease and their distribution and seasonal prevalence in Italy, and this is followed by a chapter on the various species of plasmodium and their life-histories, including those of birds, anthropoids, smaller mammals, reptiles, etc., the methods of staining, technique of cultivation and the study of them by inoculation methods. The sources and modes of infection are next dealt with; the species of Anopheles, types of eggs, the geographical distribution, the biological differences of the various strains or races of *A. maculipennis* and the relation between their dis-

tribution and malaria prevalence. The Missiroli-Hackett precipitation reaction here finds a place. Chapter VI is concerned with the survey of a malarious district and the mode of carrying it out, with dissection of mosquitoes, measurement of endemicity, splenic and parasitic indices, examination of blood and Henry's sero- and melano-flocculation and interpretation of results.

The final chapters are devoted to measures of prevention as they may be applied to man, to the mosquito and to the district—oiling, the use of Paris green, of larvicides, drainage, changing the degree of salinity of a breeding site, general bonification, etc. The choice of site, erection of houses and their protection in malarial zones, and an account of the organization of anti-malarial campaigns complete the work.

The whole is well illustrated with various graphs, plates and figures. There is a fairly full list of contents, but this cannot take the place of an index with which a work of this kind, a sort of encyclopaedia *in piccolo*, should certainly be provided. The book deserves to be, and doubtless will be, widely read. *H. H. S.*

VAN NITSEN (R.) [Médecin en chef de l'Union Minière du Haut Katanga] & DUWEZ (J.). [Ex-Pharmacien Chef de Service aux Troupes Coloniales]. **Traitement et prophylaxie des maladies des pays chauds.**—380 pp. 1934. Bruxelles: Imprimerie des Travaux Publics, Société Anonyme, 169 rue de Flandre.

A book divided into two sections : the first (158 pages) as the authors say in their preface, is an attempt to give in condensed form therapeutic methods employed in the treatment of tropical diseases including those suggested in more modern literature; the second (200 pages) is a form of abridged Belgian pharmacopoeia.

The diseases dealt with are those commonly included under the term tropical diseases and they appear in this book in alphabetical order. The treatments advocated are essentially on the side of drug treatments and details in regard to the care of the patient are dismissed in a few words. To those who are ignorant of Belgian medicine the long lists of remedies which are here given place would perhaps cause dismay. Though perhaps in no branch of medicine is active treatment so often demanded, yet with this book in his hand it would be difficult for the younger practitioner to learn to appreciate the value, on occasion, of a little " masterly inactivity."

As an example it is proposed to cite here the preparations which are advised in the treatment of blackwater fever, in this order :—to arrest haemolysis—snake antiserum, hemostil, or other antiserum, calcium chloride, hypertonic saline, intravenous glucose and sodium bicarbonate : to maintain diuresis—soda and Vichy water, cupping, injections of nephrine, lactose, theobromine, urenile, salyrgan, neptan, cyanide of mercury, papaverine ; also biocholine, colloidal iron and arsenic, adrenalin, transfusions, etc. Nowhere is the danger of syncope, if the patient sits up, mentioned. Prophylactic measures are dismissed in a few sentences. The book will doubtless be a useful one to medical men practising in Belgian and French colonies. It contains some useful information, and some points sometimes forgotten by our own medical officers but as a whole it will be quite useless in the hands of the British tropical practitioner. *H. S. Stannus.*

PATERSON (A. R.) [Director of Medical Services, Kenya Colony] with the Assistance of Many Officers of the Agricultural, Education, Forestry and Medical Departments of Kenya. **The Book of Civilization. Part I. On Cleanliness and Health, the Care of Your Children, Food, and how to get rid of Flies.**—pp. xiii+80. With 14 figs., 6 plans & 2 coloured plates. 1934. London : New York : Toronto : Longmans, Green & Co. [1s. 6d.] [Review appears also in *Bulletin of Hygiene*.]

For some years workers in different parts of the tropics have been emphasizing the necessity for recognition of the divers factors which contribute to disease production. Scientific methods of preventive hygiene must be based nowadays on a study of many subjects, such as the diets of the people, their housing conditions and the bearings of custom and traditional belief on health. It is therefore interesting and encouraging that a director of medical services in an important tropical colony should undertake the preparation of a book such as the one under review. It is a sign that the wider outlook in regard to tropical disease problems is being accepted as essential for their ultimate solution.

This book is the first of a series of parts written or to be written, arranged as Dr. Paterson calls it, for Africans, and an extensive program of instruction for self-help in housing, farming, stock-raising and much that appertains to the economic life of natives is outlined. It is a type of book which will make demands for collaboration on the part of many non-medical people.

Part one deals with the causes of sickness and the necessity for cleanliness as to village and house, hands and skin, clothes, cooking pots, food and drinking water ; outhouses, gardens and fields are discussed ; a useful chapter on the care of very young children is included. Food and flies and the means of getting rid of the latter are considered in some detail.

The book is adorned with quaint and amusing illustrations which may well appeal to the native mind. It is not a book with which the medical man in the tropics will always find himself in agreement, in detail or even in some larger issues. For example, it may appear unlikely that the future development of native farmers and villagers will be along the lines which the author envisages for Kenya. To some the thought will occur that the lot of the woman under the suggested régime is likely to be extremely laborious and they may think that it would be better to teach a girl properly on domestic matters, rather than leave this education so largely to a not too well-informed husband. In England the old policy of three acres and a cow has not much appeal in these days of laid-on water supplies, and efficient systems of disposal of excreta and refuse. The tendency in all countries which are advancing seems to be rather in the direction of less and less individual responsibility for these basic matters of public health. The suggestion of the use of filters for drinking water will appear to many readers not only inadvisable, but fraught with danger.

Nevertheless this is a book which will stimulate thought ; and there are many practical hints and a great deal of sensible information in it. The instructed reader may discover little he does not already know, but he will often be struck by the novelty in the mode of presentation.

D. B. Blacklock.

KOLLE (W.) [Director, Inst. Experim. Therap. etc.] & HETSCH (H.) [Professor Inst. Experim. Therap., Frankfort]. **Experimental Bacteriology in its Applications to the Diagnosis, Epidemiology, and Immunology of Infectious Diseases. Vol. 2.** [Edited by JOHN EYRE, M.D., M.S., etc.].—613 pp. With 62 plates & 120 text figs. 1934. London: George Allen & Unwin, Ltd. [30s.]

The treatise on experimental bacteriology by Kolle and Hetsch, the seventh edition of which appeared in Germany in 1929, has been translated into English under the editorship of Professor Eyre, who has in some respects introduced new matter, thus rendering the book less out of date than it would otherwise have been. There are two volumes which were published in September and December 1934 respectively, but it is with the second volume alone that we are dealing here. This volume, apart from seventy pages at the beginning devoted to tuberculosis and leprosy, concerns subjects which are not strictly bacteriological, namely spirochaetal and protozoal infections, and diseases due to filterable viruses and rickettsias, while there is a chapter at the end on filamentous fungi and yeasts. As the name of the book implies, it is with the experimental side of the subject that the book particularly deals, though brief accounts of symptomatology, pathology and treatment are given where these are well defined. The book is based on laboratory work and its results, and in it will be found descriptions of the various parasites themselves, the methods of their culture and identification, the procedures which are adopted for the detection of their presence in the human or animal body, the methods of their spread from one host to another, including insect transmission, the development of immunity both active and passive and the whole subject of animal inoculation and experiment. Such subjects as syphilis and relapsing fever ; malaria, amoebic dysentery and trypanosomiasis ; yellow fever, rabies, small pox and typhus ; foot and mouth disease and rinderpest; are all discussed according to the above plan. The mention of these serves to indicate the general scope of the book which is fully illustrated with 118 plates, many of them coloured, and 200 text figures. Readers will find that the book gives them a good, solid foundation of knowledge, but they will be disappointed if they expect too much in the way of the very latest information. One is even led to suspect that this would have applied in many respects even to the German original five years ago. However, the book will undoubtedly be a very useful one to possess as a guide to the generally accepted knowledge of a subject up to a certain date. *C. M. Wenyon.*

CARTAÑA CASTELLA (Pablo) & GIL COLLADO (Juan). **Estudio de las ratas y de sus ectoparásitos en ocasión del brote epidémico de peste en Barcelona en 1931.** [Rats and their Ectoparasites with Regard to the Barcelona Outbreak of Plague in 1931.]—116 pp. With 7 figs. & 12 plates. 1934. Comision Permanente de Investigaciones Sanitarias. Direccion General de Sanidad. Madrid.

More than half of this well considered and clearly written work deals with the subject of plague in general and incidentally with the application of these generalities to conditions in Barcelona. The work is divided into eleven chapters the last of which gives a summary and conclusions.

The first chapter gives a classification of the " domestic " rats and a key for identification of the genera and species, together with a list of their synonyms. A second subdivision of this chapter speaks of diseases common to man and domestic animals and the relation of the latter to the former,

e.g., plague, pseudo-tuberculosis, tularaemia, sodoku, trichinosis, infective jaundice, typhus, etc. Chapter II deals with the ectoparasites of the rodents, their life-histories, with excellent photographs and a key to the fleas and the acarines. This is followed by three chapters treating in more detail the biology of rat-fleas, their seasonal prevalence, their anatomy and mode of transmitting plague. Plague infection of rats is the subject of Chapter VI, both natural and experimental infection; in the former, the acute and chronic forms and those in which there are no detectable macroscopic lesions; in the latter the results of the different routes of infection, cutaneous, subcutaneous, intraperitoneal, alimentary tract, etc.

The remaining chapters are devoted to conditions as found in Barcelona. The results of autopsies on Barcelona rats are detailed and depicted in good illustrations in Chapter VII. The succeeding chapter deals with bubonic plague in the town from 1905, with a spot map showing the distribution of human cases in plague years; 1905 with 52 cases and a fatality rate of 19·6 per cent. [? 10 cases]; 1919 [total number not stated, but at least 7]; 1920 a single case; 1922, 28 cases in October and November; 1923, two cases, one each in November and December; 1925, one only, in March, a man who brought a cargo of plantains from the Canary Islands; 1930, four cases in October, all fatal, and 1931, 31 cases in August-December 8 fatal. In Chapter IX this last outbreak is described more minutely, the course of the outbreak and clinical characters of the cases; there follows a discussion as to the source which was not determined, whether infected rats, or fleas, or merchandise or a human case. Reviewing all these outbreaks [those of 1920 and 1925 can hardly be called outbreaks, seeing that there was but a single case in each], September–November seemed to be the usual time of prevalence, but in the 1905 outbreak which continued from June of that year to the following April, there were 15 in July and 19 in January.

The usual methods were adopted for dealing with the outbreak—notification of suspected cases, examination by experts, removal of the patient and contacts to the Infectious Diseases Hospital and isolation of the former, bacteriological diagnosis for confirmation, destruction of rats, etc.

The penultimate chapter is an account of a study of the Barcelona refuse dumps and illustrations show how insanitary dwellings, mere shacks, are in close proximity. A discussion follows on the chief methods of dealing with the town refuse, whether by incineration or by fermentation processes and subsequent use for agricultural purposes.

In the final, summarizing chapter the authors state that 8,074 rats were examined both for themselves and for their ectoparasites and 4,268 bacteriologically. Over 99 per cent. of the rats caught were *E. norvegicus*. As regards their swimming powers, the authors' experiments showed that *E. norvegicus* cannot keep afloat, in fresh water at all events, for more than 5 minutes and drowns in that time; it makes no effort to swim after 3 minutes. Some authors have stated that it can swim half a mile and can traverse a river such as the Volga.

Of 4,992 fleas caught on the rats 1,985 were *X. cheopis* and 1,643 *C. fasciatus*, *i.e.*, 39·8 and 32·9 per cent. respectively. Of all the 4,268 rats examined bacteriologically between July 1931 and January 1934, only one (in September 1931, that is in the epidemic period) showed signs indicative of plague and came from a place where four human cases had occurred. Inoculation experiments from it into guineapigs nevertheless were negative.

The authors conclude that they do not believe there was any connexion between the outbreaks on epidemiological grounds, nor that since 1905 there has been a latent enzootic of the disease. They maintain that there is a definite connexion between rats, refuse dumps and plague and that prophylactic measures must include solution of the house refuse problem and systematic rat destruction. *H. H. S.*

Printed under the authority of His Majesty's Stationery Office
By the South Essex Recorders, Limited, High Road, Ilford.
(257) Wt. P1/144 1875 4/35 S.E.R. Ltd. Gp. 353.